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INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

III

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (*Ed.*).

FIRST PART.

# ORIGINAL ARTICLES

## Viticulture in South Africa

by

Dr. A. I. Perold,

*Union Government Viticulturist.*

1. Historical. — The first vineyards were planted out in the Cape Peninsula shortly after the establishment of a Dutch settlement at the Cape in the year 1652. With the arrival of the French Huguenots in 1688 a strong impulse was given to viticultural development in this sub-continent. These Frenchmen largely came from the Province of Languedoc, in the south of France, where they had been wine-farmers all their lives. They consequently brought with them valuable information about the cultivation of the vine and the making of wine. As they settled mainly in the Stellenbosch and Paarl districts, these districts soon became important viticultural centres. It was in the Stellenbosch district, on his beautiful farm " Vergelegen ", that the Dutch Governor, Willem Adrian van der Stel, at the beginning of the 18th century, had his great vineyards of over 100,000 vines, and where he produced so much wine as to compete most unfairly with the burghers who were also wine-farmers.

Viticulture gradually spread to the surrounding districts and flourished under the excellent climatic and soil conditions obtaining there. Since then vines have been planted further inland, but this was mainly with a view to producing table grapes for personal use. With these few exceptions the wine industry is still restricted to the south western districts of the Cape Province.

The invasion of our vineyards by the phylloxera a little more than 25 years ago caused great losses to our wine-farmers and meant a tremendous set back to our wine industry. After many years of failure and uncertainty we have now reconstituted most of our vineyards on more or less

suitable American stocks. These will be discussed at some length later on in this article.

2. Distribution of vineyards. — As is well known the vine thrives best in a temperate climate. In a subtropical or tropical climate it grows very luxuriantly, but the fruit is not so valuable, and does not, as a rule, give a good wine. Further, an absence of heavy frosts in spring and early summer, as well as the absence of heavy rains in autumn, are required to make viticulture on a large scale a paying agriculturel pursuit.

A moment's consideration of the climatic conditions of South Africa will at once tell us where viticulture as a branch of Agriculture will be possible. We have first the coastal belt, where the land (exclusive of mountain ranges) does not rise to a greater altitude than about 1 000 feet. On the west coast the annual rainfall is low and irregular until one reaches as far south as St. Helena Bay. From thence southward and round the south coast as far as the George district, winter rains fall regularly, and the annual rainfall varies from about 15 to 30 inches (in George it often approaches 40 inches on account of the abundant summer rains). During the early summer months rains fall occasionally, whilst, during the last part of summer and the early autumn (January to April) it is usually rather hot and very little rain falls save in the George district as already mentioned. Beyond George the coastal belt up to and beyond Natal receives copiuos winter rain, and in the Natal coastal belt the climate is sub-tropical, whilst further south and round the Cape it is temperate. On going into the interior the land rises in terraces and the altitude gradually increases to a maximum height of some 6 000 feet at Johannesburg. Summer rains at the same time become the rule. Heavy frosts and hailstorms are also much more to be feared that in the coastal belt.

It will be easily understood from this why the wine industry is centred exclusively in the South-western districts of the Cape Province. At present the most important viticultural districts are : the Cape Peninsula with the famous Constantia area, Stellenbosch, Paarl, Malmesbury, Piquetberg, Tulbagh-Ceres, Caledon, Worcester, Robertson and Montagu. Once extensive vineyards existed in the Oudtshoorn district, but these have now been replaced by lucerne fields for ostriches. In the interior the only place where viticulture (mainly for table grapes) has been successful as a profitable industry is the town of Graaff-Reinet, where about half a million vines are still under cultivation. In the Transvaal some fairly important vineyards exist along the Mooi River in the Potchefstroom District, and on the Lombardy Estate near Johannesburg. In the former case the product of vines is mostly turned into brandy, whereas in the latter case light, somewhat thin wines are made from the grapes.

3. Climate. — For climatic reasons one can divide the principal wine districts into the following six groups.

(1) The *Constantia Area* on the Cape Peninsula, where the influence of the sea is very noticeable. The annual rainfall is heavy (25 to over 30 inches) and in comparison with say the Paarl district the seasons are late. The air contains a fair amount of moisture even during the hot summer

months, so that such diseases as Oidium and Anthracnose are particularly to be feared. Table grapes can be exported during February and March whereas the vintage takes place during March. Light rains and foggy weather are to be feared, after the 15th March.

(2) *Stellenbosch district*, where vines are planted almost from the shores of Table Bay to the flanks of Simonsberg. The influence of the sea is still noticeable in this District. The annual rainfall is good, being about 25 to 30 in. During the hot summer months it gets fairly hot and dry, but during the afternoons south-westerly winds usually blow, which have a cooling effect. The nights consequently are usually cool. Oidium is mostly to be feared in the Helderberg area where the influence of the sea is most marked. Anthracnose must be reckoned with in the case of Sultana and some other grapes that are particularly susceptible to this disease. From September to November south-easters usually blow from time to time. They have a drying influence and tend to check cryptogamic diseases. The vintage here is somewhat earlier than in the Constantia area. It usually begins about the 20th February and continues to about the middle of March.

(3) *Paarl and Malmesbury districts*: Here the influence of the sea is hardly felt. The annual rainfall varies from 20 to 30 in. The summers are fairly dry and hot, the prevailing winds are the same but the nights are usually not so cool as in the foregoing district. Oidium is troublesome in several places. Anthracnose is of more restricted occurrence. Here the vintage is earlier than in any other district. It usually begins about the 9th February and is over early in March. This is usually the hottest time of the year, the maximum temperature being anything from 95° to 104° F. or 35° to 40 C., in the shade.

(4) *Tulbagh district*: The annual rainfall is moderate, being only about 20 to 23 inches. The summers are dry and hot, but the nights are usually fairly cool and heavy falls of dew are experienced. Oidium is troublesome in parts. The vintage usually takes place from about the 15th February until early in March.

(5) *Warm Bokkeveld* (*Ceres*): This area is completely enclosed by mountains and has an altitude of 1500 feet. The winters are fairly cold. In the summer months it sometimes becomes fairly hot during the day, but much less so than say in the Paarl district. The afternoons are cool and refreshing, and heavy dewfalls are experienced. Frosts are to be feared during spring, and sometimes as late as December. The vintage usually takes place during March.

(6) *Montagu, Robertson and Worcester* (*part of district only*) *area*: In this area *karroo* like conditions prevail. The annual rainfall is low, being only about 15 inches. The vines are practically all irrigated in summer, a practice not observed to any extent in any of the other viticultural areas. Frosts during spring sometimes do great damage to the vines. The summers are hot and dry. The nights are usually cool and heavy falls of dew are experienced. The vintage takes place during March.

In all the South Western wine districts, summer rains and hailstorms

are rare, and very little damage to the vines and grapes is suffered from either of these causes.

4. Soil. — The soils in the viticultural districts vary very much and often very suddenly. It is nothing unusual to find three or more kinds of soil in one and the same vineyard. The rocks out of which the soils in these districts have been formed are mainly sandstone, granite, and shales. These have given rise to sandy soils, light, medium and heavy loams, and stiff clay soils. The purely sandy soils are often somewhat sour and practically always poor. Still they readily respond to an application of suitable manures and then give good table grapes. Among the very best soils are those consisting of decomposed granite. These soils give both good wine grapes and good table grapes. They occur in Constantia, Helderberg and other parts of the Stellenbosch district, Paarl, on the slopes of Paarl mountain, Groenberg, Riebeek Kasteel, Paardeberg and other parts of the Paarl district, Groenkloof near Darling.

The granite here has intruded into the Malmesbury shales and overlaying Table Mountain sandstone. Hence soils of decomposed granite are found either along the flanks of such mountains as the Paarl mountain, which is formed altogether of granite — the original layers of overlying sedimentary strata (shale and sandstone) having been completely removed by denudation, or in the kloofs and valleys of those mountains that are still covered with thick layers of Table Mountain sandstone. In these valleys one frequently finds a bluish stiff pot-clay as the advanced decomposition product of our biotite granites. These clay soils are very difficult to work, but if properly worked they bear good and heavy crops of grapes. They retain sufficient moisture in their lower layers not to require any summer irrigation if the vines are grafted on to suitable American stocks.

Where the Malmesbury shales have mainly contributed to the formation of the soil one finds the following holds good in a large number of cases. The surface soil is usually a coarse sandy soil or medium loam with a fair number of brown pebbles (¼ to ½ inch in diameter) and sometimes also white quartz pebbles. Below this usually comes a variable layer of gravel which rests on a yellowish clayey soil that gradually merges into a lumpy clay of a similar colour. This latter is the more or less decomposed shale into which it gradually passes. Sometimes the gravel is practically on the surface, and sometimes it is absent altogether. In the latter case we have either a medium loam with pebbles on the top or a fairly clayey soil which directly passes into the less decomposed shale. Thus we get coarse sandy soils to medium loams, gravelly soils and clayey soils or heavy loams. The total depth of the soil down to the shale may vary from some 8 to 20 inches, seldom more and often less than this maximum. Sometimes the gravel is more or less cemented by an infiltration of solutions of iron compounds and forms a hard pan. This should then be broken up, preferably by blasting with dynamite, in order to allow the roots to penetrate into the deeper, cooler layers of soil. Sometimes a layer of clay-ironstone occurs at 12 to 13 inches below the surface. This should be broken up and removed when preparing the land for vines.

Vines are sometimes also grown on deep, sandy or loamy alluvial soils along the river courses. These often produce very heavy crops and sometimes give very good light white wines.

*Karroo Soils* : The agricultural soils in the Robertson and Montagu districts are nearly all sweet. They owe their origin mainly to a shale which is fairly rich in basic elements. This shale weathers fairly easily and then gives rise to very rich soils of a yellowish to reddish colour. This is when the soils are *in situ*. They are then often somewhat stony at first, and more or less shallow. With continued cultivation and irrigation they change into loams of sufficient depth. Apart from these soils there are deep and fertile light to heavy loams which are alluvial deposits along the river courses. Most of the vineyards are planted on these alluvial soils. They are often phenomenally fertile, yields of over 6600 gallons Muscadel wine having been obtained per hectare. These soils are nearly always sweet. Still they usually contain less than one per cent of lime up to a depth of 30 inches. When the crops are good but not so exceedingly high as quoted above, the grapes easily develop up to 30 per cent of sugar and yield very excellent sweet Muscadel wines. These alluvial soils are nearly always irrigated during summer and are very liable to develop brack patches as the subsoil frequently contains large quantities of alkali salts and lime which are easily brought to the surface by careless irrigation in summer.

5. Methods of planting, pruning and cultivation. — In establishing a vine plantation the land is either trenched by hand from 24 to 26 inches deep or ploughed from 12 to 24 inches deep. In the case of the Karroo soil ploughing is the rule. These soils tend to become brackish if too much of the subsoil is brought to the surface. Trenching by hand costs anything from £ 24 to 100 per hectare. Ploughing in shallow soils is now sometimes being supplemented by blasting with dynamite. In the Montagu and Robertson districts, where the vines are often planted 3 ft. 4 in. by 3 ft. 4 in. (or 1 metre by 1 metre) a large amount of the cultivation of the soil is done by hand. In winter the land is dug over with spades and the manure is then usually brought in at the same time. In such a case the subsequent surface cultivation mainly consists of cleaning the ground of weeds. The above practice used to hold good in nearly every case prior to the destruction of our vineyards by the phylloxera. Now most of the vineyards are cultivated by means of a vineyard plough and of the Planet Junior. The winter ploughing is fairly deep and usually serves to introduce the manure. The surface cultivation in spring and during the summer months serves both to destroy weeds and to keep the surface soil loose to the depth of some 3 inches. As the summers are usually dry and hot it is necessary to keep the surface soil loose in order to diminish the loss of soil moisture by evaporation as much as possible This is absolutely necessary and is commonly done after every summer rain. Owing to this system of surface cultivation hardly a single grafted wine is now being irrigated in other than Karroo soils. In order to make this cultivation possible the vines have mostly been planted from 4 ½ ft. by 4 ½ ft. to 6 ft. by 6 ft. in squares.

In the pre-phylloxera days *unrooted* but selected vine cuttings were

planted out. Now-a-days rooted, grafted vines are exclusively planted. These grafted vines are sometimes produced by the farmer himself, but in most cases he buys his grafted vines either from the Government at the Tokai Reformatory near Wynberg in the Cape Peninsula, or from some nurseryman or fellow farmer who also goes in for grafting vines.

The man who grafted most vines last year was a young vine-farmer in the Paarl district, who grafted more than $^3/_4$ of a million vines. The Government grafted vines are usually sold by public auction at Tokai in July, when prices ranging from £ 5 to £ 20 per 1000 for first class grafted vines are obtained.

At the 1914 Government sale prices ranged from £ 5 to £ 12 per 1000, and most of the grafted vines were sold at about £ 7 per 1000. The prices depend on the kind of grape, the American stock on which it is grafted, and finally, on the demand there is at the sale for each kind of grafted vine. The farmers and nurserymen usally get lower prices than the Government, viz : £ 5 to 10 per 1000, whilst most of their grafted vines are sold at from £ 6 to £ 8 per 1000.

Buyers maintain that the Government article is usually of better quality and more reliable than that of the private individual.

The grafted vines are usually layered in the soil as they come from the nursery, and are well covered with earth to prevent them from budding too early. In September and October these vines are planted out. Their roots are cut back close up to the stem, and the upper part is cut back so as to leave just one bearer of 2 or 3 eyes standing in the direction of the stem of the vine itself. The vine is planted so deep as to have the spot where it is grafted just about 1 inch above the ground on level land, and even with the ground on a slope. This is done in order to prevent the European or vinifera vine from growing on its own roots and at the same time so as not to expose too much of the American stem, as it usually forms little bark and is thus liable to be cracked by our hot sun.

Immediately the vine is planted the soil is firmly pressed around it and a small mound of loose earth, usually about 12 to 15 inches in diameter, and just high enough to cover the top of the vine, is heaped about it.

In very stiff clay soils sand is carted to the vineyard to cover these mounds of earth and thus to prevent the formation of a hard crust which the young shoots sometimes have a great difficulty in breaking through.

The young vines must be kept topped short to prevent them from being damaged by strong winds.

Instead of planting grafted vines some people prefer to plant out either plain cuttings or rootlings of American vines which are grafted over on the spot with some variety of grape during the next season. Those vines that are then still too thin, say under 1 cm. diameter, are grafted only the following season.

In somewhat dry and difficult soils it is usually best to plant out American rootlings and to graft them over on the spot. In these cases the vineyards easily become uneven if the misses are not regularly replaced by grafted vines or American rootlings. If the vines are already fairly big

it is found best to replace a missing vine by a strong American rootling which must be grafted over on the spot with a *grafted* vine. It thereby becomes possible to graft some 6 inches below the surface of the ground and yet keep the European or vinifera part away from the ground so that it cannot send out its own roots. Both the established American vine and the American part of the scion then give roots to feed the young vine which practicaly never fails.

When the grafted vine is pruned for the first time *i. e.* some 11 months after it is planted, it gets only one bearer of 2 to 3 eyes. The next year it gets 2 bearers of 2 to 3 eyes, then 3 to 4 bearers, so that after some 8 years most vines will have 3 to 4 arms with 4 to 8 bearers. This applies to the bush type of vine, where the « taille en gobelet » is practised. These are self-supporting and form the predominating type in South Africa. Stakes or échalas are practically unknown. Only a small percentage of our vines is trellised. As most varieties give good crops with short pruning (bearers with 2 to 3 eyes) usually only those that need long pruning, such as Cabernet Sauvignon, Sultanina, etc., are trellised, and even these often not trellised but simply have their long bearers intertwined and tied up so that each vine stands by itself and is unsupported. Severe summer pruning is practied. During the months of October and November the vines are kept topped very short to prevent the tender shoots from being blown off by the wind and to favour the setting of the berries. The suckers and surplus shoots are broken out in October-November, but this is only done in a small number of cases. The growing shoots are not tied up in any way. Where vines grow very vigorously they are cut open with sickles during January and February to enable the grapes to ripen better and the grape pickers to walk freely among the vines to gather the grapes. If rain should fall during the vintage, large numbers of leaves are removed to give the sun direct access to the grapes and thus as far as possible to prevent them rotting.

6. Vine Diseases. — On the whole these are not very bad. This, no doubt, is due to the dry and hot weather usually experienced during the summer months.

The principal insects that cause trouble are « Phylloxera », Root-eels, Calanders and Mealy bug (*Dactylopius*).

The Phylloxera made its appearance at the Cape some 25 years ago and has now destroyed nearly all the old vines so that today nearly 90 % of all our vines are grafted on American stocks.

*Root-eels or Nematodes.* — In very sandy soils they destroy the European vines and also certain American stocks, such as Constantia Metallica and 1202.

*Calanders*: are most troublesome in young plantations where the soil has recently been trenched. Here again they are ever so much more troublesome in clay and « turf » (peaty) soils. They cut the young leaves and shoots and can therefore do tremendous damage. Later on they also eat the green grapes, both the berries and the stalks. When the grapes start ripening they usually disappear. This I suppose is due to the excessive heat at this time of the year. In old established vineyards they seldom get

very bad. About the simplest way of getting rid of calanders is to remove the soil around the vine and so make a litle hollow at the root of the vine at the beginning of the rainy season, say April. After this has been done for say a couple of years they usually disappear. To check them during spring and summer by spraying with arsenate of lead is quite effective.

*Mealy Bug* (*Dactylopius*) causes some trouble in trellised vines in the Cape Peninsula and surrounding parts. It is difficult to get at. Fumigation with prussic acid is good, but it is rather difficult and costly to carry out. Experiments on this pest are now being carried on by the Government Entomological Department.

In addition to the foregoing pests, cutworms often do great damage to young shoots of vines that have just been planted, or to young grafts, as they eat out the buds or cut the young sprouts.

*Oidium* is our most common fungoid disease of the vine. It is worst in the Cape and Stellenbosch districts, where, owing to the proximity of the sea the atmosphere nearly always contains a fair amount of moisture during the summer months The varieties that are most liable to suffer are Riessling, Stein, Cabernet Sauvignon, Greengrape, and White French. Hermitage and several other varieties are seldom seriously attacked. In many inland wine districts such as Worcester, Robertson etc., Oidium usually causes so little trouble that many farmers never sulphur their vines.

In the districts where Oidium is to be feared the vines are sulphured from the time the young shoots have an average length of about 6 inches until about six weeks before the vintage, at intervals of 2 to 4 weeks as may be necessary. In most cases the vines are sulphured only twice, namely when the shoots have an average length of about 6 inches and again when the young berries are still quite small.

Many farmers are under the erroneous impression that vines should not be sulphured while they are flowering. Excellent brands of both flowers of sulphur and ground sulphur are used with equally good effect.

7. MANURING OF VINES. — In the fertile alluvial soils very little manuring is done. Farmyard manure is relied upon mainly. Unfortunately most wine-farmers produce too little of it to meet their requirements. It is usually given at the rate of about 6 tons per morgen or 6500 kilos per hectare, (5830 lbs per acre) every second or third year as the case may be. Government Guano fron the Government Guano Islands and sheep manure from the Karroo or its ash are given. The Government Guano contains about 12 % Nitrogen, 11 % Phosphoric oxide and just under 12 % Potash. It is mainly a rich nitrogenous fertiliser. The Karroo sheep manure contains about 1.4 % of Nitrogen, 0.85 % phosphoric oxide and 4½ to 5 % Potash, whilst its ash contains about 1½% Phosphoric oxide and 9 to 10 % Potash. The Government Guano obviously goes very well with Karroo manure or ash. I have recommended 500 lbs Government Guano and 1500 lbs Karroo manure or 600 lbs Government Guano and 1500 lbs Karroo manure or 600 lbs Government Guano and 600 lbs Karroo ash per morgen of vines. This gives respectively about 81 lbs

Nitrogen plus 68 lbs Phosphoric oxide plus 84 lbs Potash and 72 lbs Nitrogen plus 75 lbs Phosphoric acid plus 70 lbs Potash per morgen of vines.

These mixtures have thus far given good results. Some farmers also use bonemeal and some basic slag. Green manuring with legumes in vineyards is not yet being done to any extent, but I am sure that it will soon be taken up seriously as it offers several advantages. It not only introduces nitrogen and vegetable matter into the soil, thereby improving the soil both physically and chemically, but it also protects the soil from washing during winter when we get heavy rains which often cause serious washaways on slopes, and it fixes plant food which might otherwise have been washed out of the soil in winter.

Many farmers keep their vine canes in the vineyard and bury them either in deep furrows or in holes systematically made between the vines. The canes should be exposed to the air for a month or so before being covered up, as they then rot ever so much more easily.

I recommend the following system of manuring:

*1st, year*: Farmyard manure at the rate of 7 tons per morgen to be broadcast and ploughed in during the first half of July.

*2nd, year*: 600 lbs Government Guano and 600 lbs fresh Karroo ash per morgen. This should be broadcast and ploughed in during early July.

*3rd year*: Ordinary field peas or vetches to be sown with 400 lbs basic slag and 300 lbs Karroo ssh per morgen. The seed should be sown in a furrow drawn in each row of vines, and should be in early in May, so that it can make rapid growth and be ploughed under about the beginning of September.

*4th year*: 400 lbs bonemeal per morgen to be broadcast and ploughed in during June.

*5th year*: As the first year and so on.

8. AMERICAN STOCKS AND SELF BEARERS. — At the Cape we had the same experience as practically every other viticultural country that had to reconstitute its vineyards on American stocks, namely, that unsuitable stocks were used to a very large extent at first. A certain Rupestris seedling that was selected on the Government Wine Farm, Groot Constantia, and called *Constantia Metallica*, was the worst in this respect. It is, at first, a very vigorous grower, taking well when grafted, and soon bearing heavy crops, but it is absolutely useless in most soils. In very sandy soils it is readily attacked and destroyed by root-eels; in clay soils it rarely gets older than 8 to 10 years, when it is destroyed by Phylloxera; in deep, loose, cool, medium loams it succeeds well, but such soils are not of abundant occurrence.

As fully one-third of our grafted vines are on this stock, its numerous failures have been a severe blow to our industry. It is almost everywhere worthless and will therefore in future not be used as a graft bearer to any extent. Jacquez has thus far been very largely used as a graft bearer. At least one fourth of all our grafted vines have been reconstitued on Jacquez. It is a vigorous grower and takes very well when grafted. The plain cuttings give a high percentage of successful grafts, 80 % to over 90 % being easily

obtained. It has a very wide affinity for nearly all varieties of grapes, including Hanepoot or Muscat d'Alexandrie, which is very exigent in this respect and thrives only on a very limited number of American stocks. Thus far all our varieties thrive well on Jacquez. Hanepoot vines grafted on Jacquez still do very well after more than 20 years. Although Jacquez has also been used for other varieties of grapes, it has most largely been used for Hanepoot, which is our most extensively cultivated table grape. In fairly deep and cool soils that are not too stiff and do not get very dry, Jacquez does well in the Cape, Stellenbosch, Paarl and surrounding districts. In the sweet soils of the Karroo districts, such as Robertson, Montagu, Worcester (part), etc., Jacquez is often seriously damaged and even destroyed by the phylloxera. Great losses have already been suffered in these districts. In these sweet soils the phylloxera seems to attack the vines more severely. I may add that these vineyards are irrigated in summer, whilst those in the first named districts where Jacquez is a successful graft bearer, are not irrigated at all. They get copious winter rains.

*Aramon × Rup. Ganzin Nos.* 1 *and* 2. — Amongst our graft bearers Aramon easily takes the third place for the number of vines grafted upon it. It is one of our most successful stocks, and, but for the low percentage of successful grafts obtained in bench grafting (30 to 40 %), would long ago have been used more than any other stock. At present Aramon is being used more generally than in the past. This is due to its own excellence and to the general failure of the Constantia Metallica. Unfortunately our Aramon is a mixture of Nos. 1 and 2. In most cases they have both given full satisfaction, but within the last couple of years I found vines grafted on Aramon N° 2, suffering and dying in a broken to stiff clay soil, that gets dry in summer. Often the European vine alone died back whilst the Aramon gave wild shoots from below. Phylloxera was present in large numbers on the roots, which had been visibly damaged. In stiff clay soils that keep fairly cool and moist in their sub-soil during the summer months, Aramon No. 2 bears much bigger and more vigorous vines than No. 1. On our hills the latter seems to resist drought somewhat better than the former. Most of our varieties of grapes do well on them, only Hanepoot (Muscat d'Alexandrie) being again the glaring exception. It dies on both kinds of Aramon in 3 to 5 years time. Our experience with Aramon generally can be summed up as follows: vigorous grower, fairly drought resistant, satisfactory affinity for most of our grapes and practically everywhere sufficiently phylloxera resistant.

*Riparia Gloire de Montpellier.* — This is one of our best stocks and was one of the first American stocks imported into South Africa. Its phylloxera resistance is higher than that of almost all other stocks. It stands drought well where the soil suits it. Vines grafted on this stock bear well and their grapes ripen well. As it further has a good affinity for nearly all our grapes including Hanepoot, it is a most excellent stock in its right kind of soil. In poor sandy soils it gives rather small vines, but in fairly good soils that are deep and not too stiff, it gives very good results. It has unfortunately

not been planted to anything like the extent it deserves. It will be used more freely in the future.

*Mourvedre* × *Rupestris* 1202. — Whilst the foregoing stocks have now been used for more than 20 years at the Cape, 1202 has been used to any extent only during recent years. It is being used as a graft bearer for Hanepoot particularly on the Karroo soils where Jacquez is too unreliable. It gives vigorous vines, but has the great drawback that a considerable number of the vines, mainly Hanepoot, grafted on it die off during the first couple of years. This gives an uneven vineyard, and is most unsatisfactory. Other varieties of grapes have not yet been grafted on it to any extent, so that it is still in the experimental stage.

The same may be said about 3306, 3309, 101-14, 41 B, 333 E. M., 420 A., 157-11, 34 E. M., 125-1, 1 R, 106-8, 1616 and Rupestris du Lot with which experiments are now being conducted in the different districts.

*Self-bearers*: properly so called have not yet been tried for any length of time. In the past some small plantations of Jacquez and Othello have been established for harvesting their grapes, but there is hardly any demand for their wines. Some years ago I imported the following self-bearers from M. Paulsen of Palermo:

Seibel 117, 127 and 755; Couderc 199-88 and 241-125; Malègue 292-1 and Oberlin 591.

These self-bearers are all growing well so far, but it remains to be seen whether they can resist the phylloxera sufficiently. As we are not troubled much by vine diseases, I doubt whether self-bearers will ever be planted to any great extent. These above mentioned are however being experimented with.

9. GRAFTING AND NURSERY WORK. — Although a considerable amount of grafting is done on the spot, by far the larger number of our grafted vines have been grafted on the bench, put out into nurseries and then planted out as 1 year old grafted ones. The former method has already been partially described under the planting of vines. The best results are usually obtained by doing this grafting rather late in the season, say late in September or early in October, after the American vines have already started budding.

A small mound of earth is heaped up around the vine so as just to cover the top of the scion and to prevent it from drying out as has already been described under " planting ". It is essential that the surface of the mound be kept loose, as the young shoots of the scion on starting to grow cannot easily pierce a hard crust and sometimes grow in curls under this crust, thus forming worthless shoots. The mound must be wide enough, at least 12 inches, to keep the scion moist. It is not necessary to tie up the grafted spot with raffia when thus grafting on the spot. For reasons previously given it is necessary to keep this spot about one inch above the surface of the ground in case of level land, and about level with the ground in case of sloping land.

Once the scion has given young shoots (3 to 6 in. long), the wild suckers from the American stock are carefully removed and the young shoots are at first kept topped short (about 9 in.) to prevent them being blown off by strong winds. About the time the scion begins to form buds and young shoots cut-

worms are often troublesome. They are best got rid of by working over the mounds around the scions by hand and killing all cut-worms thus found. If Calanders get troublesome they can soon be checked by spraying with Arsenate of lead.

With regard to *bench grafting*, which is the most common system, it has already been pointed out that the Union Government at the Tokai Reformatory, Wynberg, as well as private nurserymen and wine-farmers themselves produce these grafted vines. Most of them grow their own American vines for grafting, but some buy parts of their stocks either from the Government Wine Farm at Groot Constantia or from wine-farmers, who do not themselves go in for grafting or who produce more American vines than they require. These are cut in lengths of about 15 inches and are usually $^1/_3$ to $^2/_5$ inch or about 8 to 10 mm. in diameter. The average price for the last 10 years has been 10*s*- per 1,000 for Aramon Rupestris (Nos. 1 and 2 mixed) and 20*s*- per 1,000 for Jacquez. They are cut from the mother vines in May and June, and are often earthed in before being grafted. The vinifera shoots that serve as scions are selected in the vineyards, when these are pruned in July and are earthed in till required for grafting. They should be well covered with earth to prevent premature budding. The scions are mostly given two eyes.

The graft is the common whip-tongue graft. The grafted vine is usually tied with raffia to keep the scion in position. Proper stratification is not practised. Some people plant out the grafted vines in the nursery immediately after grafting. Most successful are those who pack the grafted vines in heaps with clean sand, either under cover or in the open fields, leaving them there till they are planted out in September or early October. They are by this time properly callused and start budding. They are planted out in the nursery in rows 12 to 15 inches apart and about 3 inches apart in the rows. It is essential that the nursery soil should be trenched or ploughed to a depth of at least 15 inches, be well manured with chemical fertilisers and contain sufficient moisture and a large proportion of sand. It should be well drained, and so situated that it could be irrigated if necessary. Until the young grafts have made some growth, the soil must be kept sufficiently moist without being cold and wet.

Our largest nurserymen are now departing from the system of planting the grafted vines in ridges. It is found that the best results are obtained by putting the grafted vines at an angle of about 30° to 45° with the surface of the ground and letting the top of the scion just penetrate the surface. The grafted spot will then be about 1½ inch below the surface. In this way the drying out is very much diminished and up to 90 % of successful grafts are obtained. In January and February the roots of the scions are cut off, and in May these grafted and rooted vines are dug up and earthed in a fairly dry place, where they are kept till they are despatched to the respective buyers. The trimming of these vines is usually left for the buyer to do just previous to planting. As we have no mildew (*Plasmopara Viticola*), it is not necessary to spray nursery stock. Against Oidium the vines in the nursery are sulphured once or twice. When the buds come out cut-worms may do damage, but the danger is small where no stable manure

(particularly fresh manure) is used. Where they are troublesome they must be killed by hand.

As previously stated £6 to £8 per 1,000 is now the average price for grafted vines, and this price will fall in the near future, as there will not be a great demand for grafted vines owing to the poor prospects of viticulture in South Africa.

10. EFFECTS OF GRAFTING ON THE QUANTITY AND QUALITY OF THE GRAPES AND WINE. — There is no doubt that vines grafted on suitable American stocks come into bearing earlier, grow more vigorously and give heavier crops than ungrafted vines. If these vines are allowed to give such heavy crops, the quality nearly always suffers and in the end the vine itself suffers, and may then even be killed by Phylloxera. If the wine-farmer exercises a little common sense and does not allow his vines to overbear, he can continue to get good results year after year. As the vines grow older they get into a state of equilibrium where the faults of youth disappear and the quality of their products rises easily to that of the ungrafted vine, and sometimes even exceeds it.

Also at the Cape Riparia gives vines with great fertility, whilst their grapes have a tendency to ripen earlier and better, and get sweeter than when ungrafted.

Whilst Hanepoot or Muscat d'Alexandrie gives normal bunches on Jacquez, I have seen it on Herbemont, when 3 years old in a somewhat sour sandy soil, giving short roundish bunches of about half the size of a normal Hanepoot bunch. The shape and taste of the berries was normal, but the canes of these vines showed a *creeping*, low growth as against the normal, upright growth on Jacquez next to it. These are certainly very marked effects of grafting, which cannot be denied, but they were limited to the above mentioned external modifications and did not extend to the organoleptic properties of the grape itself. From this it follows that the nature of the wine made from such grapes would not be influenced by the grafting, so long as the vine is only allowed to bear a normal crop.

It has further been observed that the non-setting (" coulure ") of berries is strongly influenced by the graft-bearer. In a certain instance Hanepoot which was growing very vigorously on 1202, was found to be very bad in this respect, whilst such was not the case with Hanepoot which was next to the first named, and was grafted on Jacquez and on 101-14 and was making sufficient but no very vigorous growth.

It may be said generally that our experience was just the same as that of France and other wine countries, which have reconstituted their vineyards on American stocks. It is the only sensible thing to do against phylloxera in a hot climate, particularly as neither the quantity nor the quality of the products of the vine are thereby adversely affected under proper cultivation and care, and in certain cases decided advantages are gained thereby, for instance greater vigour, higher drought resistance and consequently better maturity.

11. VARIETIES OF GRAPES. — Here it will be necessary to classify the varieties according to the dates of their introduction. The oldest varieties

some of which may have been cultivated at the Cape, for 100 or 200 years, include the following : Greengrape (red and white), Stein or Vaalblaar Stein, Old Stein, White French (very much resembling Palomino from Jérez in Spain), Muscadel (white and red), Frontignac or rose coloured Muscat de Frontignan, Pontac and Hanepoot (red and white). Of these, white Greengrape somewhat resembles Sémillon. White Hanepoot is the same as Muscat d'Alexandrie, while the red Hanepoot is supposed to have originated from a vegetative sport of White Hanepoot at the Cape.

The following varieties are of more recent introduction, but are also largely cultivated : Hermitage (same as Cinsaut), Kanaan, Sultanina, Raisin Blanc, Waltham Cross, Black Prince, Barbarossa, Cabernet Sauvignon, Riesling (which is found to be the same as old Stein), etc. The most recent introductions, which have not yet been largely cultivated, are: Gros Colman, Henab Turki, Ohanez (white Almeria grape), Flame-coloured Tokai, Bonnet de retord, Sauvignon blanc, Sémillon, etc. A large number of new varieties have been introduced quite recently and are still in the experimental stage. So far most of them are very promising. The climate makes it possible to grow almost any kind of grape with success. At present our principal cepages for white wine are Greengrape, White French and Stein, for red wines Hermitage (most common) and Cabernet Sauvignon, for sweet wine Muscadel.

Our best and most largely cultivated table grapes are red and white Hanepoot which predominate, Hermitage, Raisin Blanc, Waltham Cross, Gros Colman, Barbarossa, Black Prince, etc. Raisins are made from Hanepoot and Sultaninas.

The high class table grapes that are exported with the greatest success to Covent Garden (London) and other markets, are, in order of merit, Red and White Hanepoot (Red being the better of the two), Gros Colman, Barbarossa, Raisin Blanc and Hermitage, Waltham Cross, Bonnet de retord. Flame-Coloured Tokai and Henab Turki are also excellent export grapes, but they are not yet actually exported to any great extent. Experiments are now being conducted with the varieties of tables grapes recently imported. The Ohanez or White Almeria grape grows and keeps very well. Trial shipments will be made in 1916 of this grape. It has not been found necessary to assist its pollination by passing over the flowering bunches with a soft woollen brush as must be done in the Province of Almeria in Spain. This variety will probably have a great future at the Cape.

12. Methods of Wine-Making. — In the olden days when our modern machinery for wine-making was still unknown, the grapes were crushed in a tub by the human foot. This tub was fitted with a false bottom so as to allow the grape juice to run off into a lower tub. The crushed stalks and husks were then put into a kuip, (*i. e.* an open wooden tub about 6 ft. deep and holding on an average some 6 leaguers or nearly 790 gallons) which was filled to within 16 inches from the top. Here a spontaneous open fermentation took place. In the case of white wine the usual rule was to de-vat (" décuver ") as soon as the floating cake of husks started subsiding. The fermenting must was

then run into a stukvat ("foudre") where the fermentation stopped, after some 3 to 4 days. This vat usually was lightly sulphured by burning one sulphur "Mêche" in it prior to pumping in the fermenting must. Frequently a small sandbag was placed over the bunghole whilst the fermentation proceded. The 8th day after devatting the young wine was drawn off from the thick lees and pumped into a well sulphured stukvat, about ½ "mêche" being burnt for every leaguer the vat held. One month later the wine was racked over into a thoroughly sulphured vat (about 1 "mêche" of sulphur for every leaguer the vat held) where it remained until the end of winter or until it was sold. The red wines were allowed to ferment longer (4 to 5 days) on the husks, but were otherwise made as indicated above. In fact very little red wine was made at the Cape until about half a century ago. It was only since the introduction of Hermitage and Cabernet Sauvignon and certain other varieties of black grapes that a considerable amount of red wine was made. The old wines mostly had a reddish or yellowish tint owing to Red Greengrape, Red Hanepoot and Red Muscadel. The lastnamed was the most highly coloured of all. Light wines were then almost unknown. Most of the wines were fullbodied and heavy, and frequently sweetish. Such wines as the then famous Sweet Constantia were made from overripe grapes, which had partially turned to raisins on the vines, and consequently gave musts with over 30 per cent of sugar. The grapes were generally allowed to ripen well. It seems almost incredible that good wines could thus have been made in a hot climate where temperatures often run to 100 to 104 degrees F. (37.8-40 degrees C.) in the shade during the pressing season when no refrigerators or potassium metabisulphite or liquid sulphur dioxide was available to control the high temperatures of fermentation, which further was a spontaneous one. I can only ascribe the success to the great *cleanliness* practised by the wine-farmers of those days (I speak of some 50 years ago and more) and to the fact that the grapes were allowed to ripen well under the burning South African sun. Farmers of those days were very particular about keeping their fustage and cellar utensils perfectly clean, which is most important in a hot climate. I do not think that they always kept their casks brim full, but this mattered less than it does now, as they always made wines of a heavy type which do not easily turn sour. Then came a period covering, roughly, the last thirty years, when lighter wines were being made, and when, it seems to me, wine-farmers no longer knew so much about wine making as their forefathers did, and certainly no longer took the same pains as the old people did. In this period also came the invasion of our vineyards by the phylloxera with the inevitable result that the young grafted vines bore heavy crops of grapes which could not possibly give the same high percentage of sugar as the old vines did. Further, Hermitage (same as Cinsaut) was largely planted and gave heavy crops of a rather light red wine. The result was, that the old type of heavy good wine almost disappeared. In its stead lighter wines were made, which very often were unsound and naturally destined for the still. Concurrently with these a much smaller amount of excellent sweet wines were made, mainly by adding spirits of wine to the fermenting must.

During the last ten years or so very great improvements have taken place in our wines. Individual farmers have taken the advice of the Government experts and built decent cellars, acquired the necessary machinery and generally conducted their fermentations on such lines as warranted success.

The excellent light wines that are now made owe their existence mainly to the introduction of the must refrigerator and of potassium metabisulphite In other words, to be able to make excellent light wines we had *to control and lower the high temperatures of fermentation.* Had we endeavoured to make our wines in the same way as the famous Hocks and Clarets are made in Europe, we might have obtained bad vinegar, but certainly no good light wine. Algeria has served us as an excellent model to copy. Conjointly with the above, I feel sure that the use of pure levures will assist us in the manufacture not only of better but of sounder wines. In the Paarl and Stellenbosch districts the vintage falls between the 10th of February and the end of March, which very often is the hottest time of the year, so that temperatures of 100° F (37.8° C.) in the shade are often experienced. It is obvious that under such circumstances the temperatures of fermentation, if unchecked, will rise very high. In one of my own experiments the temperature in a 2 leaguer cask (11 ½ hectos) went up to 41° C., whilst a brisk fermentation was proceeding. The yeast at the Cape has become accustomed to high temperatures and to high doses of alcohol. At the present time the good light wines (white and red) are made either by relying mainly on metabisulphite or on refrigeration, or on both.

In our hot climate and with our sweet grapes (usually 18 to 25 per cent of sugar and often higher) large doses of metabisulphite are required to prevent or retard the fermentation. Sometimes doses of 400 mg. sulphur dioxide per litre of must have failed to prevent fermentation for more than about a week. This dose certainly has not been a dose " mortelle ". Usually about 10 to 20 grammes of metabisulphite are used per hectolitre of must (*i. e.* about 50-100 mgs sulphur-dioxide per litre must). The ideal thing for making light wines, however, is to inoculate the fresh must with good pure levures and to keep the temperature, during fermentation, below 86° F (30° C.), preferably about 77° F or 25° C.

The ordinary wine-farmer still continues to allow the main fermentation to take place on the husks, but he has given up crushing his grapes with the aid of the the human foot and does it all by a grape crusher or " fouloir ". In the case of white wines the must is removed from the husks and stalks as soon as the cake or " Chapeau " commences to sink which usually happens on the 3rd or 4th day after the grapes are crushed. Those farmers possessing wine-presses then press as much wine as possible out of the husks, usually keeping the press must separate from that drawn off previously. The fermenting must is then pumped into a lightly sulphured stukvat where it either completes its fermentation or else becomes stuck, as the case may be.

The red wine is made in a similar fashion, only the must is left longer (5 or 6 days) in contact with the husks.

The progressive farmers and co-operative wineries improve consider-

ably on the foregoing. Their delicate light white wines they make by separating the must from the husks and stalks immediately after crushing the grapes. The press must is often added to the rest with good results. Pure Cape levures selected and cultivated by the Government Viticulturist are used, or starters which are made in the usual way from picked, sound, ripe grapes. The fermentation takes place in open cement or wooden vessels, or in closed stukvats. Some keep down the temperature of fermentation by cooling with cold water (this is the best method) while others often use metabisulphite from the start, thus delaying the commencement of the fermentation and often giving the hot must a chance of first cooling off somewhat. The bisulphite further has a selective effect on the microflora in the must, as it gives the wine levures an advantage over the other micro-organisms and thus causes a purer and cleaner fermentation.

It further causes the fermentation to proceed more slowly than would otherwise have been the case, and thus keeps down the maximum temperature of fermentation very considerably. The amount used varies generally from two to four ounces of metabisulphite per leaguer (about 125 gals), which amounts to about 54 to 108. mgs. sulphur dioxide per litre of must. It is customary to give the lower dose at the start, and to repeat it if the temperature of fermentation goes up to 95° F. or 35° C. and higher. Certain delicate and very good light white wines are made by immediately separating the fresh must from the husks and stalks, and at once adding about ½ lb of metabisulphite per leaguer of must or 2000 lbs weight of grapes — this amounts to about 216 mgs. $SO_2$, per litre of must. This effectually prevents the fermentation for several days. As soon as the thick stuff has properly settled, the clear super-natant liquid is drawn off into an open or closed vat, inoculated with pure levures and aerated by pumping for an hour or so. After some days, or may be a week, the must commences to ferment. The wine easily gets dry and then becomes a nice wine if the grapes originally were suitable. (White French is the best grape for this kind of wine) and if the wine receives the proper cellar treatment, which consists of racking the young wine off its thick lees about two days after the main fermentation has stopped. The cask into which the wine is pumped is first lightly sulphured. Here a slight fermentation usually takes place and the wine then becomes clear.

After about one month it is racked into a well sulphured cask, which is filled completely and is kept full by continually filling up with some suitable wine specially kept for this purpose. At the end of winter, that is, about the end of August, the wine is again racked into a well sulphured cask, which is also kept full.

After the first year the wine is again racked the following August. Certain of our light white wines must then be bottled, *i. e.* when 18 months old, as they would otherwise become too dark in colour, and would develop a sherry character. All our white wines show this tendency. Some of these can, however, be matured in wood (usually in stukvats holding 40 hectolitres or about 880 gals.) for 2 ½ years, when they are bottled. Prior to bottling these wines are generally fined in the usual way.

It must be pointed out that, where necessary, tartaric acid is added to the must before fermentation starts. White French, when properly ripe, usually has an acidity of 4.5 to 5‰ as tartaric acid. Enough tartaric acid is added to bring the total acidity up to 6 ‰. Tannic acid is sometimes but not generally added.

Full bodied white wines are usually made by letting the crushed grapes ferment on their husks and stalks for 12 to 24 hours. This is not really necessary, but for the ordinary farmer it is better to have this initial open fermentation as he has then a better chance of fermenting out all the sugar in his sweet must than if he were to have a closed fermentation from the beginning without using either pure levures or an ordinary starter. The acidity is usually not raised in the case of full bodied vines, as this is neither necessary nor desirable. The rest of the treatment is similar to the one described above. *Red Wine* is generally made by using a fouloir-égrappoir whereby the stalks are removed leaving the husks and must to ferment together.

Sometimes pure levures or ordinary starters are used, but more often than not the fermentation is purely spontaneous. Tartaric acid and metabisulphite are used as before. The cake of dops (*i. e.* husks) is pressed under every 2 hours or so during the period of active fermentation. Where cooling is impossible this gives better results than permanent submersion of the cake, if high temperatures of fermentation are to be reckoned with. Where cooling is possible, the permanent submersion of the cake is preferable. After 3 to 4 days of active fermentation the young wine is drawn off and the dops are pressed. The press wine is usually added to the rest as it intensifies its colour, introduces more tannin, and generally tends to make the wine more full bodied. If the husks show signs of any bad fermentation, the press wine is naturally kept by itself. The cellar treatment is similar to what was given above. The red wines get bright much sooner than the white wines, but they take longer to develop. It usually takes them 2 to 3 years to become sufficiently matured for bottling.

The principal faults in the wine making of our ordinary wine-farmers are :

(*a*) Too high a temperature of fermentation (over 35 degrees C. or 95 degrees F.) which frequently results in a mannitic fermentation and a bad wine.

(*b*) Too long open fermentations which easily lead to an acetic fermentation and gives sour wines.

(*c*) Carelessness in keeping casks full, which leads to the growth of flowers of wine and acetic bacteria, which ultimately finish up with a sour wine.

13. Viticultural products. — Our wines are all on the heavy side. This is borne out by the fact that wines for distillation are bought at a minimum strength of 20 per cent *proof spirit* or 11.3 Vol. per cent alcohol. If they are under this strength less is paid. Very few wines ever fall below this strength. On the whole the alcoholic strength of unfortified Cape wines varies from just over 11 till nearly 15 Vol. per cent of alcohol, most of them being near 13 Vol. per cent. Some of our best light white wines

come just under 11 Vol. per cent. It is, however, not uncommon to find wines of over 15 Vol. per cent of alcohol. At the Paarl Viticultural Station I myself made a natural wine which ultimately fermented dry and had a strength of 17 Vol. per cent of alcohol without any fortification whatsoever. I have heard of similar cases happening at the Cape. Hence the local practice in making sweet wines is to fortify up to 17 to 18 Vol. per cent of alcohol. This clearly shows that our yeasts have got accustomed to high doses of alcohol.

Our light types of white wine cannot easily be compared with European types although some of them remind one of a hock. The term « Drakenstein » is applied to white wines of medium strength, usually of 12 to 13 Vol. per cent of alcohol. From 1½ to 2½ years in wood and some 6 months in the bottle is all the maturing these white wines want. They are very apt to get dark in colour and become "maderisé" if kept too long in wood. If kept for some years in a cask which is not kept full, our white wines have a marked tendency to assume a sherry character. The stronger white wines that are not distilled are usually worked up into sweetish or sweet wines, Cape sherries, etc.

The red wines are mainly made from Hermitage (the bulk), Cabernet Sauvignon, Pontac and Red Muscadel. The first two are used for dry wines, whilst the two last-named are mostly used for sweet wines.

In the Constantia district Hermitage (the same as Cinsaut) gives a very good red wine, whereas further inland the quality goes down. Our best red table wines of a Claret type are made in the Constantia district. These are mainly blends of Hermitage and Cabernet Sauvignon. Sometimes smaller amounts of Shiraz, Verdot, Malbec, etc. are included in the blends. The heavier blends are sold as Cape Burgundies. In the past there used to be a good demand for Pontac ("Teinturier"). Of late this demand has rapidly decreased. Pontac used to be made pure, either dry or sweet, or entered to a certain extent in making blends of dark wines for Cape Ports.

The sweet dark wines are usually made from Red Muscadel in the Worcester, Robertson and Montagu districts. These are mostly made by adding so much spirits to the fresh must as to check the fermentation before it gets started. Some sweetish wines are also made by fortifying the wines to about 17 Vol. per cent alcohol when the fermenting must still has about 8 to 10 per cent of sugar.

Some fairly good Cape Ports and Sherries are being made by the big wine firms. During the last couple of years the varieties most commonly grown in the Douro valley and round about Jérez de le Frontera have been imported to the Cape and experiments are now being conducted to see what kinds of Ports and Sherries can be made at the Cape out of the grapes used for this purpose in Portugal and Spain. So far the results are very promising.

A large proportion of our wines is being distilled for making brandy or to get spirits for the purpose of fortification. The brandy is either "Grape Brandy", which is distilled at about 20° Cartier or 52.4 Vol. per

cent of alcohol from grape husks and grape juice (fermented) or "Wine-Brandy" or "Wine-Brandy" (Cognac type). The "Wine-Brandy" is a compound brandy. It is made either from spirits of wine up to 96 Vol. per cent alcohol or from a spirit of wine distilled at about 60-70 Vol. per cent alcohol, which is subsequently broken down with water to the consumption strengh of not less than 25 degrees under proof or 43 Vol. per cent. The broken down spirit is then flavoured, coloured and sweetened to a maximum of 1 per cent cane sugar. It is usually sold quite young. When made from pure and highly rectified spirits of wine it is clean in taste and will do no harm unless it be consumed in such quantities as to cause harm on account of the excessive amount of alcohol consumed. The "Wine-Brandy" (Cognac type) is made by distilling wine at 60-69 per cent by volume (the "Wine, Spirits and Vinegar Act of 1913" lays down that it shall not be distilled at higher than 22 O. P. or 69 Vol. per cent alcohol) and maturing it in wood for some years. This brandy may be sweetened by adding pure cane sugar up to 1 per cent, and it may be coloured in the usual way by means of pure caramel, but in its case *no flavouring is allowed*. It must therefore develop its flavour naturally whilst maturing in wood. Thus far some very good wine brandies of this type have been made by carefully distilling the "brouillis" as is done in the Deux Charentes in France and then maturing in Limousin or other oak hogsheads. After two years in wood the brandy has already matured sufficiently to be marketed if it is blended with a small proportion of a brandy one or two years older. Under our climatic conditions the brandy matures much faster than in France. Of course, if kept still further in wood the brandy will further mature and gain very much in quality. This brandy when sufficiently matured forms an excellent substitute for French Cognac. The two are of course not identical, neither is there any necessity for this in order that Cape Cognac may claim its place under the sun. Experiments are now under way to find out whether still better Cape Cognacs or wine brandies of Cognac type can be made by using the same grapes as in the Deux Charentes, namely Folle Blanche and Colombard and in addition also Jurançon and Saint Emilion. Hitherto this brandy was distilled from such local varieties as Greengrape, White French, etc.

To the best of my knowledge the Union of South Africa is at the present time the only country in the world, where the making of "Dop Brandy" or "Eau-de-vie de marc" is forbidden by law. Our Wine, Spirits and Vinegar Act of 1913 has put dop out of existence altogether. Hence Cape spirits of wine must be distilled from wine only and will no doubt still make a name for itself in the world's markets.

Amongst our viticultural products I must still mention table grapes and raisins.

Our production of *table grapes* is at present increasing fast. This is due to the very remunerative prices that are obtained in London and elsewhere for really first class grapes. This export trade is still in its infancy, but is now growing by leaps and bounds. The difficulties of packing and suitable transport in cool chambers are rapidly disappearing. Our great-

est trouble at present is the scarcity of labour for properly thinning and trimming the bunches, when the berries are still small. Without proper thinning the best prices cannot be otained. The varieties mostly exported are (in order of decreasing excellence) : Red Hanepoot, White Hanepoot (Muscat d'Alexandrie), Gros Colman (Dodrelabi), Barbarossa, Waltham Cross, Hermitage, Raisin Blanc and several other varieties. These grapes are exported from near the end of January till early in April. They are mostly packed in 10 lb. boxes, which fetch from 4 to 15 shillings in London. Since these grapes arrive in Europe when fruit is very scarce and there are no other grapes worth talking about in the market, it is to be expected that they will always fetch good prices. I feel sure that this export trade is going to grow very much in future. Once a remunerative price is guaranteed, millions and millions of vines could be added to those now growing as there are large tracts of suitable land available for this purpose, and the climate is most excellent for the production of high class table grapes.

The Ohanez or White Almería grape, which is now sent in such large quantities to London and the continent of Europe from the Province of Almería in Spain, has a great future at the Cape. It grows very well and gives satisfactory crops where it has been pruned and trellised according to the Almeria system. Once its value is fully realised, it will be grown very largely indeed. As it is late—it ripens here between the end of March and the beginning of May, and at the same time hardy, so that it can stand some rough handling and can be shipped to Europe as cargo in the hold of the ship and does not need to be put in cold store, it can be shipped in bulk and sold with a good profit at much lower prices than the delicate, high class table grapes.

With regard to *Raisins*, I may state that we produce stalk and loose raisins made from Hanepoot or Muscat d'Alexandrie and Sultanas made from Sultanina blanche. In both cases the fresh grapes are steeped into a suitable caustic lye, which is kept boiling. The ganna-ash, which is obtained by burning the ganna-bush that grows in the little Karroo (Robertson, Montagu, etc), gives a splendid lye, and is consequently largely used. In addition to it, caustic soda and caustic potash are used to quite a considerable extent. Some farmers steep the grapes into fresh water after having immersed them in the hot lye. They (Sultanas only) are then usually put into a sulphur-house, where they are exposed to the fumes of burning sulphur for some 10 minutes or so, and are then dried by the sun. This treatment bleaches the grapes and results in a lightly coloured raisin of good keeping qualities. The Sultanas are practically all dried on wooden trays, but the Hanepoot raisins are only partly died on these trays, whilst as much if not more is allowed to dry on ground which has previously been hardened and given a smooth surface.

The raisins are of quite good quality, although they are not yet equal to the best Málaga stalk raisins. The Sultanas are of excellent quality and have completely ousted the imported article out of the South African Markets.

14. THE LABOUR QUESTION. — Contrary to what most outsiders may

think, the labour question is a serious one to the wine-farmer. The labourers consist mainly of Cape coloured people, who represent a mixture of the original Bushmen and Hottentots together with imported negroes, mainly from Mozambique, and some Malays from the East. Some of them also contain a little European blood. They are usually fairly intelligent, and many of them are splendid workers, getting through more work than the average white labourer in most European countries, but the majority of them are only fair, whilst a considerable number are poor. White labourers are usually working foremen and overseers on the farms. There are at present not many ordinary white labourers.

During the last ten years or so there has been a marked tendency amongst the coloured labourers to migrate to the towns. The reason probably is that in the towns they do odd jobs during a number of days in the week at rather higher wages than in the country, and can then afford to be idle for several days in the week whilst they are within easy reach of the canteens to satisfy their craving for alcoholic drink. Others go there to work in jam, boot and other factories, or to learn some trade such as the carpenter's or builder's trades, etc. The result is that hands on farms have become scarce and higher wages have to be paid. The working hours on almost all farms are from sunrise to sunset with a break of half an hour for breakfast about 8 a. m., and another of an hour for luncheon at 12.30 p. m.

During the long summer days a short rest of about a quarter of an hour is usually granted at about 10.30 a. m. and another at about 4 p. m., when each labourer usually gets some wine (about ¼ of a bottle) or in the afternoon a cup of coffee for those who do not drink wine. This is done in particular when heavy work is going on.

The usual practice is to give each family of labourers a two-roomed cottage with a piece of ground for a vegetable garden varying in size from an teighth to a quarter of an acre. Each family usually keeps a couple of pigs and about half a dozen fowls. No rent is charged for the cottage, but the labourer and his family must work for the owner whenever their services are required, and they must usually give one month's notice before they leave. As a rule all the males above the age of 8 years work on the farm for the greater part of the year. They can only go and work on other farms after they obtain permission for this from the owner of the farm.

The wages vary a good deal, but generally an adult labourer is paid about 2/6 a day (in exceptional cases 2/9 or even 3/-) if nothing else is given. Most farmers give their men some wine, 4 to 6 times during the day, the total amount being usually 1 to 1 ½ bottles per day, although in rare cases as much as 2 bottles of wine are given for the day, which is certainly too much. Where wine is thus given 2/ to 2/3 is paid as the daily wage. Considerable numbers of farmers still continue the old system of feeding their labourers 3 times a day and giving them 1 to 1 ½ bottles of wine, together with £ 1 per month or 1/- per day in money. Daily paid boys are only paid for the days when they actually work. The practice of feeding the boys and paying then less in money is by far the best, as the farmer is thereby

placed in a position to feed his labourers properly and keep them in a good physical state, whilst they get less money to waste in drink or spend in other ways in the towns.

As the farmer produces all the vegetables on the farm and usually grows part or all the meat he requires, he has only to buy the wheat, some fish and possibly some meat, so that he gets his labour decidedly cheaper than when it has all to be paid for in money. Had it not been for the tremendous reduction in the amount of manual labour through the introduction of machinery, both in the establishment and the cultivation of the vineyards and in the cellar work, the scarcity of labour would have been felt far more then is the case at present.

15. GOVERNMENT AID FOR PROMOTING THE INDUSTRY. — Years ago the Government bought the estate known as "Groot Constantia" for a Government Wine Farm. A competent person with a special knowledge of Viticulture, and Wine-making was always kept in charge of the farm, amongst other things to conduct experiments in viticulture and wine-making. The farm itself was originally laid out by the famous Dutch Governor Simon van der Stel, during his reign at the Cape (1679-1699), and is a lovely estate on the south-eastern slopes of Table Mountain. The homestead and old cellar are two of the best examples of the so-called old Dutch style of architecture at the Cape.

Some work was done here in American stocks, of which a fairly large number is still being sold yearly to the public. Further, a small collection of grapes was established. About ten years ago new and spacious cellars and a fermenting house were built on modern lines and the necessary machinery was installed. Very excellent dry red and white wines are produced on the estate. The famous "Sweet Constantia" that used to be produced on this estate many years ago and sold so well in England and on the Continent, is now unfortunately no longer made, although a nice sweet muscadel wine is still made that somewhat resembles the sweet Muscat de Frontignan.

In March 1910 the Cape Government bought a small property in the town of Paarl for a Viticultural Experiment Station. This property lies high up on the slopes of the Paarl Mountain. The soil is decomposed granite and is splendid for vines. The place was then laid out for an experiment station by the author of this article in his capacity as Goverment Viticulturist. At the present time it contains an Ampelographic collection comprising upwards of 200 varieties of wine and table grapes, most of which have been trellised and are in full bearing. These include the local varieties and most of the best varieties cultivated in the European and North African wine countries. There are, further, several varieties of "self bearers" (Producteurs directs) which are being tested. Suitable plantations of the varieties of Port vines (12 varieties) and of Sherry vines (4 varieties) have been established, and experiments are being conducted to make Port Wine and Sherry from these grapes. The results are thus far very encouraging. Different varieties of wine and table grapes have been trellised on high pergolas (as seen by the author at San Michele in the Tyrol), to determine the quality of wine and table grapes that can be obtained under such circun-

stance. It may be pointed out that our grapes easily become sunburnt and form too much sugar for light wines when they are grown too close to the ground as in the case of the untrellised bush vines. Hence this experiment may have far reaching effects. An experimental plantation of Ohanez (the White Almería grape) trellised overhead, as is done in the Province of Almería in Spain, is now in bearing. The vines grow very vigorously and are so far bearing very well for their age. The grapes ripened very late last year (15th to 30th April) and were of good quality.

The viticultural experiments include manurial trials and methods of combating vine disease.

Further experiments are being conducted in different methods of wine-making. The wines are studied while maturing and some of them are ultimately bottled. Experiments in the making of a Cape Cognac Brandy are also conducted. Some good results have already been recorded. An outstanding feature is the great rapidity with which the brandy matures.

From this Experiment Station cuttings of the different varieties of wine and table grapes are sold to the Public, after they have been thoroughly tested. There is a manager permanently in charge of the various operations at the Experiment Station, who takes his instructions from the Governement Viticulturist.

At the Elsenburg School of Agriculture in the Stellenbosch district an *Oenological Institute* is just being completed by the Government to serve as a centre of Oenological research. The present Government Viticulturist is also the Director of this Institute, and he has an assistant to help with the research work.

This Institute contains the necessary chemical, physiological, and bacteriological laboratories, yeast room, sterilizing room, incubating, dark and sterile rooms, museum, library, office and storerooms and a lecture room for popular courses. These lastnamed courses will be held each year in viticulture and wine-making for farmers and others intrested.

A number of field and cellar experiments is conducted by the Lecturer in Viticulture and Wine-making at the Elsenburg School of Agriculture. Among these is a large experiment with 24 different varieties of American stocks in a stiff clay soil, where their suitability as graftbearers in this soil for 98 different varieties of grapes will be tested.

The Government Viticulturist further conducts experiments with about a dozen of the best American stocks on 20 different farms throughout the wine districts, to find the most suitable stocks for each district. He further writes articles to the Union Agricultural Journal and other papers, prepares bulletins and delivers lectures to farmers on Viticulture and Wine-making, replies to enquiries sent in by farmers on viticultural and oenological matters, sends out to all wine-farmers, gratis, on application, cultures of pure Cape wine levures selected and cultivated by himself, and visits farmers from time to time for the purpose of giving advice on the spot.

Apart from the above mentioned instructional and research work for which the Government makes provision, the Cape Government in 1907 started 9 *Co-operative Wineries* in the different wine districts. One of these

never worked and had to be abandoned after it was completed. The remaining 8 are still working today. The Governent advanced all the capital for these wineries, which amounted to about £100 000. The wineries had to pay 6 % on the loan, of which 4 % was to be for interest and 2 % for amortisation. As money was advanced so readily and on such liberal terms, the capital mistake of sinking too much capital into buildings and equipment was made. Another mistake was that seven farmers were considered enough to form a co-operative winery. The result was that several wineries for a number of years made only 500 to 800 leaguers of wine, which meant that the costs that had to be deducted per leaguer of wine made were too high. Some wineries tried to sell their wine by retail as the big wine merchants at first fought shy of these wineries. After a struggle of a year or so they all had to revert to the wholesale trade by selling their wine to the big wine merchants.

Today the 8 co-operative wineries make together about 8000 leaguers of wine, or about 15 % of our total wine crop. The wines range from excellent light, dry, white wines and some red wines, to heavy full bodied wines. On the whole they produce sound and quite good wines. Sometimes some bad wines were made where no competent wine-maker was engaged. This is still the weak spot in some of the wineries. Directors are very slow to realize that such a winery requires a properly trained man to make and look after the wines while they mature. Where this is done good results are obtained. Where an ordinary wine farmer is put in charge the wines are, as a rule, nothing special, and only about the same as made by the ordinary farmer on his farm.

The net result of the establishment of these wineries has thus far been, that a larger quantity of sound wines is made, that one excellent light white wine of a hock type (the "Witzenberg" made by the Drostdy Co-operative Winery near Tulbagh) is put on the market, and finally that outside farmers improved their cellars, machinery and vats as a result of what they saw in these wineries.

Thus far the spirit of co-operation has, however, not yet taken hold sufficiently of our wine farmers to make the creation of new cooperative wineries appear likely in the near future. Once all these wineries have competent wine-makers in charge and turn out such good wines as will command decidedly better prices than are obtained by the other farmers outside of the wineries, there will be every chance of the movement spreading. Unfortunately this is not yet the case at the present time. I may add that most of these wineries would have gone insolvent if the Union Government had not reduced their liabilities some years ago by amounts varying from about 45 to 65 % of the original Government advances. Now they can all be considered as sound. Finally it may be stated that the Government has passed certain *Adulteration Acts* about Spirits, Wine and Vinegar from time to time, which are quite as strict as similar laws of leading European wine countries.

16. Statistics. — The following statistics are taken from the official Census taken on 7th May 1911, in the Union of South Africa.

TABLE I. — *Number of Vines in the Union of South Africa.*

| Variety | Union of South Africa | Cape Province | Transvaal | Orange Free State | Natal |
|---|---|---|---|---|---|
| Greengrape | 19 490 458 | 19 478 142 | 8 935 | 3 222 | 159 |
| Hanepoot | 13 883 114 | 13 312 838 | 295 173 | 273 392 | 1 711 |
| Hermitage | 7 965 729 | 7 937 955 | 14 937 | 12 124 | 713 |
| Stein | 6 056 506 | 6 053 985 | 1 307 | 1 004 | 210 |
| White French | 5 591 697 | 5 557 402 | 10 757 | 23 507 | 31 |
| Muscadel | 2 858 629 | 2 726 519 | 107 950 | 24 012 | 148 |
| Other varieties | 12 908 341 | 12 306 123 | 464 516 | 110 952 | 26 750 |
| Totals | 68 754 474 | 67 372 964 | 903 575 | 448 213 | 29 722 |
| Percentage distribution amongst 4 Provinces | 100 % | 98 % | 1.31 % | 0.65 % | 0.04 % |

From this table it will be clear that the viticultural industry is almost exclusively limited to the Cape Province. In this province again 91,55 % of its vines, or 89,47 % of those in the whole Union, are in the 10 South-Western districts mentioned near the beginning of this article under «Dis-

TABLE II. — *Number of Vines in the t*

| Variety | Paarl | Worcester | Stellenbosch | Malmesbury | Cape |
|---|---|---|---|---|---|
| Greengrape | 9 857 196 | 2 563 700 | 1 864 825 | 2 414 599 | 223 87 |
| Ranepoot | 994 068 | 5 444 672 | 288 511 | 175 101 | 968 08 |
| Hermitage | 2 576 884 | 98 700 | 3 182 512 | 194 275 | 601 38 |
| Stein | 274 150 | 6 000 | 4 211 332 | 74 674 | 559 57 |
| White French | 1 135 777 | 919 800 | 10 903 | 66 300 | 255 78 |
| Muscadel | 354 700 | 200 900 | 27 175 | 68 600 | 103 58 |
| Other varieties | 2 912 653 | 1 807 606 | 1 014 603 | 1 249 348 | 1 513 72 |
| Totals | 18 105 428 | 11 641 378 | 10 599 861 | 4 242 897 | 4 226 00 |
| Percentage of Cape Province | 26.87 | 17.38 | 15.73 | 6.30 | 6.27 |

tribution of Vineyards ». The following statistical table shows their relative importance:

The last column in the above table shows the relative importance of the various varieties of grapes grown in the Union of South Africa. It clearly brings out the large preponderance of Greengrape (28,35 %) over all other varieties. Its grapes are turned into wine and brandy. The next striking feature is the very large percentage of Hanepoot (20.19 %) grown. Its grapes are consumed and exported as table grapes, or turned into raisins, or wine or brandy. This is probably the only country in the world where Hanepoot forms such a large percentage of the total vines grown.

The census report unforunately does not give the area under vines. As the number of vines per morgen varies from 8 000 to 3 000, it is somewhat difficult to determine the area under vines. Still it is pretty safe to assume on an average 5 000 vines per morgen. At this rate there will be about 13 750 morgen or 28 306 acres under vines in the Union of South Africa, of which 12 303 morgen or 25 322 acres are in the 10 South-Western districts of the Cape Province where the industry is mainly centred. It must be pointed out that since the 1911 census, and particularly since the great slump in ostrich feathers, large numbers of vines have been planted in those districts (Robertson, Montagu, Ladysmith, Oudtshoorn, etc.) where ostrich farming was in the past *the* agricultural industry. The 1916 census will, therefore, show large increases in the above figures.

The *sizes of our wine farms* vary a good deal. In most cases the wine farmer is also a fruit farmer, and in many cases he is also a grain grower,

*outh Western Districts of the Cape Province.*

| Robertson | Tulbagh & Ceres | Piquetberg | Montagu | Caledon | Total for 10 districts | Total for Union | Percentage of total Vines in Union |
|---|---|---|---|---|---|---|---|
| | | | | | | | % |
| 108 100 | 1 322 562 | 214 400 | 95 300 | 423 349 | 19 087 906 | 19 490 458 | 28.35 |
| 1 301 380 | 482 304 | 544 320 | 395 970 | 177 392 | 10 771 802 | 13 883 114 | 20.19 |
| 48 200 | 281 690 | 60 000 | 24 550 | 197 600 | 7 865 797 | 7 965 729 | 11.58 |
| 1 100 | 285 150 | 430 800 | — | 155 300 | 5 998 080 | 6 056 506 | 8.81 |
| 1 442 170 | 104 850 | 160 426 | 492 550 | 60 912 | 4 649 477 | 5 591 697 | 8.13 |
| 701 400 | 104 630 | 22 450 | 714 300 | 23 200 | 2 320 935 | 2 858 629 | 4.15 |
| 482 554 | 459 011 | 921 796 | 130 310 | 328 752 | 10 820 354 | 12 908 341 | 18.79 |
| 4 084 904 | 3 040 197 | 2 354 182 | 1 852 980 | 1 366 505 | 61 514 351 | 68 754 474 | 100.00 |
| 6.06 | 4.66 | 3.50 | 2.75 | 2.03 | | | |

so that there are few wine farms where vines, and vines only, are cultivated. In those cases where viticulture is the chief branch of farming, the farms are from 10-200 morgen or 20.5 to 410 acres in extent, and the average will be about 50 morgen or 102.5 acres. The numbers of vines grown vary from about 10 000 to 300 000, and the average number will be about 30 000. In most cases only a small portion of the farm is planted with vines. For this the best and most suitable land is selected.

Let us now consider the statistical figures about the *Products of the Vine* in the Union of South Africa. The following table has been compiled from data given in the 1911 census report. The grape crop is given as so many baskets of grapes, which can be taken to weigh on an average about 50 lbs. or 22.7 kilos.

TABLE III. — *Grape Crop* 1911.

| Province | Total Crop | Made into Wine | Made into Brandy | Made into Raisins | Remainder |
|---|---|---|---|---|---|
| Cape | 5 695 970 | 3 560 368 | 492 032 | 340 370 | 1 303 200 |
| Transvaal | 26 773 | 5 524 | 3 924 | 512 | 16 813 |
| Orange Free State | 27 833 | 518 | 9 | 597 | 26 709 |
| Natal | 3 106 | 863 | — | 8 | 2 235 |
| Total for Union of S. A. | 5 753 682 | 3 567 273 | 495 965 | 341 487 | 1 348 957 |

TABLE IV. — *Production of Grapes in the ten South-Western Districts of the Cape Province.*

| District | Total Crop | Made into Wine | Made into Brandy | Made into Raisins | Remainder |
|---|---|---|---|---|---|
| Paarl | 1 473 318 | 1 003 426 | 10 362 | 14 973 | 444 557 |
| Worcester | 1 154 823 | 572 356 | 75 272 | 208 605 | 298 590 |
| Stellenbosch | 931 575 | 840 744 | 525 | 343 | 89 963 |
| Robertson | 426 654 | 241 237 | 139 251 | 17 146 | 29 020 |
| Montagu | 283 368 | 237 023 | 30 404 | 7 875 | 8 066 |
| Malmesbury | 273 823 | 223 786 | 580 | 763 | 48 694 |
| Cape | 242 152 | 128 678 | 3 780 | 774 | 108 920 |
| Tulbagh-Ceres | 174 090 | 133 067 | 14 843 | 3 733 | 22 447 |
| Caledon | 110 841 | 93 165 | 3 559 | 3 391 | 10 726 |
| Piquetberg | 57 707 | 38 429 | 5 221 | 1 235 | 12 822 |
| Total for these 10 districts | 5 128 351 | 3 511 911 | 283 797 | 258 838 | 1 073 805 |

TABLE V.

| | Total Brandy made | Wine made | | | Vinegar made | Raisins made | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | White | Red | | Total | Stalk | Loose | Sultana | Currants |
| | gals. | gals. | gals. | gals. | gals. | lbs. | lbs. | lbs. | lbs. | lbs. |
| Cape Province | 617 040 | 7 488 897 | 5 463 272 | 2 055 625 | 31 786 | 2 522 739 | 124 980 | 2 229 055 | 157 547 | 11 157 |
| Transvaal | 4 503 | 10 248 | 4 445 | 5 803 | 203 | 843 | 295 | 548 | — | — |
| Orange Free State | — | 20 | 5 | 15 | 178 | 1 196 | 35 | 1 134 | 25 | 2 |
| Natal | — | 1 848 | 310 | 1 538 | — | 50 | — | 50 | — | — |
| Total for Union of South Africa | 621 543 | 7 501 013 | 5 468 032 | 2 032 981 | 32 167 | 2 254 828 | 125 310 | 2 230 787 | 157 572 | 11,159 |
| 10 South-Western Districts of the Cape Province: | | | | | | | | | | |
| Paarl | 121 756 | 2 299 644 | 1 824 004 | 475 640 | 10 686 | 134 621 | 25 730 | 108 364 | 437 | 90 |
| Worcester | 102 967 | 1 295 559 | 1 065 256 | 230 303 | — | 1 685 554 | 14 050 | 1 587 730 | 80 094 | 3 680 |
| Stellenbosch | 43 442 | 1 080 480 | 944 755 | 635 725 | 3 158 | 3 055 | 100 | 2 620 | 300 | 35 |
| Robertson | 50 072 | 523 999 | 411 794 | 112 205 | 127 | 152 153 | 1 000 | 80 025 | 70 362 | 766 |
| Montagu | 23 350 | 386 737 | 182 250 | 204 487 | 2 095 | 107 822 | 35 835 | 62 643 | 3 815 | 5 529 |
| Malmesbury | 28 146 | 496 386 | 427 127 | 69 259 | 365 | 6 178 | 18 | 6 140 | 20 | — |
| Cape | 9 681 | 321 416 | 151 400 | 170 016 | 127 | 30 | 15 | 15 | — | — |
| Tulbagh-Ceres | 23 016 | 322 219 | 267 674 | 54 545 | — | 42 226 | 4 000 | 38 076 | 150 | — |
| Caledon | 12 729 | 141 844 | 106 060 | 35 784 | 1 111 | 16 830 | 6 150 | 10 415 | 250 | 15 |
| Piquetberg | 4 269 | 69 581 | 55 217 | 14 364 | 876 | 11 320 | 7 880 | 3 440 | — | — |
| Total | 419 428 | 7 437 865 | 5 435 537 | 2 002 328 | 18 545 | 2 159 789 | 94 778 | 1 899 468 | 155 428 | 10,115 |

Table III shows that 99.00 % of the total grape crop of the Union is produced in the Cape Province, whilst, as has previously been shown, 98.00 % of the vines are in this province.

Again taking the 10 South-Western districts previously mentioned, we find the figures given in Table IV as their production of grapes (in bushel baskets).

Thus the total grape crop of these 10 South-Western districts is 90.03 % of that of the Cape Province and 89.13 % of that of the Union of South Africa. The three leading wine districts, Paarl, Worcester and Stellenbosch, together produce more than 60 % of the total grape crop of the Union.

Table V gives the statistical figures about the wine, brandy, vinegar and raisins made in the various parts of the Union.

In the above table the brandy, wine and vinegar are given in gallons and the raisins in pounds. The total wine crop amounts to 7 501 013 gallons of this 72.9 % is white wine and 27.1 % is red wine. Only in case of 2 districts is more red wine made than white, namely in the Cape district, where our best light dry red wines (Claret and Burgundy types) are made, and in the Montagu district, where some of our best sweet and dry Muscadel wines are made. The vinegar made in 1911 in very much less than what is at present produced. In case of the Worcester district no vinegar is shown in the 1911 census, whereas a most modern and large vinegar factory now exists in the town of Worcester, where excellent vinegar is being produced in large quantities. The raisin industry is mainly centred in the Worcester district, particularly in Goudini, where 66.8 % or two-thirds of the total raisin crop of the Union of South Africa is produced. The Sultana raisins are mainly produced in the Worcester and Robertson districts, which together produce 95.5 % of the crop of the whole Union. The currants are in reality a small berried kind of red Muscadel. The true Black Currant of Greece is not yet grown in this country.

It is finally interesting to note that the 10 South-Western districts produce 99.0 %, and Cape Province produces 99.8 % of the total wine crop of the Union.

SECOND PART.

# ABSTRACTS

## AGRICULTURAL INTELLIGENCE

### GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES

**1 – Compensation Claims under the Agricultural Holdings (Scotland) Act 1908. —** *Board of Agriculture for Scotland, Leaflet*, No. 30, pp. 1-8. Edinburgh 1915.

This Act confers on agricultural tenants a right to compensation for specified improvements made by them on their holdings and also, in certain circumstances, compensation for "unreasonable disturbance" and for damage by game.

These improvements are divided into the following three classes:

CLASS I. — *Improvements for which Consent of Landlord is required.*

1. Erection, alteration, or enlargement of buildings.
2. Formation of silos.
3. Laying down of permanent pasture.
4. Making and planting of osier beds.
5. Making of water meadows or works of irrigation.
6. Making of gardens.
7. Making or improvement of roads or bridges.
8. Making or improvement of watercourses, ponds, wells, or reservoirs or of works for the application of water power or for supply of water for agricultural or domestic purposes.
9. Making or removal of permanent fences.
10. Planting of hops.
11. Planting of orchards or fruit bushes.
12. Protecting young fruit trees.
13. Reclaiming of waste land.
14. Warping or weiring of land.

15. Embankments and sluices against floods.

16. Erection of wirework in hop gardens.

CLASS II. *Improvements in respect of which Notice to Landlord is required.*

17. Drainage.

CLASS III. — *Improvements in respect of which Consent of or Notice to Landlord is not required.*

18. Chalking of land.

19. Clay-burning.

20. Claying of land or spreading blacs upon land.

21. Liming of land

22. Marling of land.

23. Application to land of purchased artificial or other purchased manure.

24. Consumption on the holding by cattle, sheep or pigs, or by horses other than those regularly employed on the holding, of corn, cake, or other feeding stuff not produced on the holding.

25. Consumption on the holding by cattle, sheep or pigs, or by horses other than those regularly employed on the holding, of corn proved by satisfactory evidence to have been produced and consumed on the holding.

26. Laying down temporary pasture with clover, grass, lucerne, sainfoin, or other seeds, sown more than two years prior to the termination of the tenancy.

27. Repairs to buildings, being buildings necessary for the proper cultivation or working of the holding, other than repairs which the tenant is himself under an obligation to execute : provided that the tenant, before beginning to execute any such repairs, shall give to the landlord notice in writing of his intention, together with particulars of such repairs, and shall not execute the repairs unless the landlord fails to execute them within a reasonable time after receiving such notice.

As regards all the classes, the compensation for such improvements is their value to an incoming tenant.

The Act provides that any contract or agreement made by a tenant of a holding, by virtue of which he is deprived of his right to claim compensation in respect of any of the improvements referred to, shall be void so far as it deprives him of that right.

No claim can be enforced unless it is made before the termination of the tenancy.

The Act does not prescribe any particular form in which a claim may be made.

If it be found that a settlement cannot be reached the parties should themselves endeavour to agree on the appointment of a single Arbiter.

If they fail to agree either party may apply to the Board of Agriculture for Scotland to make such an appointment.

Except in the last year of tenancy a tenant has now entire freedom, in spite of the custom of the country, or the provisions of his lease, to practise any system of cropping of the arable land (not including land which by the lease the tenant is bound to keep in grass throughout be tenancy) and

to dispose of the produce of his holding. If, however, this right be exercised the tenant must make suitable and adeguate provision to protect the holding from injury or deterioration, and, if he sells or removes the produce in contravention of custom, lease, or agreement, he must, as soon as practicable, return to the holding the full equivalent manurial value thereof.

In so far as he only makes good such injury or deterioration by means of any of the improvements of the third class he is not entitled to compensation therefore. On the other hand, if he fails to make good such injury or deterioration the landlord may claim damages and require the same to be dealt with by arbitration.

2 - **Development of Agricultural and Forest Resources of Liberia.** — MANGHAM R. C. F (Consul-General at Monrovia). — *The Board of Trade Journal*, Vol. XCI, N° 990, p. 499 London, Nov. 18, 1915.



The most important items in the export trade of Liberia are palm oil, palm kernels, piassava (the fibre obtained from the fronds of the *Raphia vinifera* Beauv.) rubber, ginger, ivory and kola-nuts.

The amount of rubber shipped from Liberian ports during 1913, according to the Customs statistics, was greater than that exported in the preceding year by 18 000 lbs. The circumstance which chiefly operates to bring the bulk of this valuable product to the United Kingdom is the fact that the supervision of the rubber royalties throughout Liberia is vested in an important British association (1) which possesses, in addition to certain rights of a concessionary character, a large plantation of *Hevea* (Para) rubber situated a few miles from Monrovia. This plantation has an area of about 1 100 acres actually planted, and contains some 135 000 trees, of which by far the greater number are already yielding rubber. By the cutting season of 1916 the entire plantation will have reached maturity.

Enquiries are again being made for that once valuable dye known as camwood (the product of the *Baphia nitida* Lodd.), the price of which, owing doubtless to the shortage of dyes consequent upon the war, has advanced from £10 per ton in 1906 to between £20 and £25 per ton. Camwood is largely produced in the forests of Liberia, and no difficulty should be experienced in obtaining it in considerable quantities.

The prices commanded in home markets by Liberian cocoa, namely, £3 to £3 5*s.* per cwt., are not so high as those realised by the more carefully prepared products of some of the neighbouring West African coast lands. It has beeen stated that the increase in the cultivation of this plant has largely coincided with the fall in the value of coffee.

No attempt has yet been made to cultivate, for the exportation of copra, the luxuriant coconut palm, found at all points of the Liberian coast, where it grows neglected and disregarded, eclipsed no doubt by the importance of the palm-oil palm.

(1) The Liberian Rubber Corporation. (*Ed.*)

3 - **Agricultural Development in the Roman Campagna: State of the Work on June 30, 1915.** — *Ministero di Agricoltura, Industria e Commercio, Direzione Generale dell'Agricoltura, Servizi Speciali: Relazione presentata alla Presidenza della Camera dei Deputati dal Ministro di Agricoltura, Industria e Commercio* (CAVASOLA), 12 pp., figs. 63, Plates 9. Rome, 1915.

An account of the work carried out by the Ministry of Agriculture and by the Commission in Charge during the period of 4 years ending June 30, 1914 and conforming to the law of July 18, 1910, No. 491, the provisions of which may be summarised as follows:

1) Extension of the provisions of the special text of the law of November 10, 1905 No. 647, beyond the zone of 1903.

2) Necessity of encouraging the formation and development of centres of agricultural colonisation, to assist in the re-settlement of the territory coming under the law.

3) Formation of a Colonisation Bank independent of State aid.

4) Development of Stock breeding and of the systematic cultivation of grass land.

5) Means of modifying certain clauses of the old law, for the better application of the reduction of registration and mortgage taxes, extension of the terms fixed for the execution of work in connection with irrigation, water supply, etc. benefiting under the State grant of 30 per cent. and the facilitation of work of linking up the projected roads with the nearest railways stations and tramways.

Between 1907 and 1914 mortgages to the value of £448 328 were contracted, of which £ 292 204 has been administered. The rural towns or centres of colonisation included in the concessions mortgaged during the period 1912-14 were three in number ; two others are in course of negotiation. A special Colonisation Bank was established in order to encourage and assist the various works and schemes, especially those relating to agricultural instruction, the control of malaria and the reduction of the number of illiterates. This Bank since its foundation in 1910 until June 30, 1914 received over £ 82 800 and payed out nearly £ 66 400.

The " *Istituto Zootecnico Laziale* " is engaged in the improvement of forage crops, live stock and dairying in the Roman Province.

With this object the following programme is being carried out :

*a*) Breeding of selected animals beloging to the best Italian and foreign races of cattle, sheep and pigs, most suitable to the conditions. The acclimatisation and distribution of animals also forms part of the work.

*b*) Experiments on methods of reproduction, rearing, feeding, fattening and the care of live stock.

*c*) Provision of farmers and breeders with breeding stock for the improvement of their stocks.

*d*) Encouragement of the development of the cheese industry especially that part concerned with milk, by means of research, experiments and lectures.

*e*) Instruction in and the diffusion of scientific methods of cultivation, harvesting and preparation of forage, the use of machines and modern apparatus for these purposes.

*f*) Studies of the hygienic and sanitary conditions of live stock in the Province, researches on the cause of epizootic diseases and the best means of prevention and treatment.

*g*) Instruction in the best and most rational methods of breeding and improvement of live stock, by means of example, lectures, publications, advice and explanations; short practical courses in zootechny, cheesemaking, aviculture, rabbit breeding and care of grass land.

*h*) Maintenance of model poultry farm with selected breeders; distribution of improved breeds for breeding and of fertile eggs for incubation.

*i*) Provision of a stud farm for public use subject to special regulations.

The Institute is also occupied, so far as its means allow with horse breeding.

The premiums and subsidies distributed according to the provisions of the law have in view the provision of drinking and irrigation water; the immigration of families, formation of rural centres; the control of malaria; the reduction of the number of illiterates; the appointment of a travelling agricultural lecturer for the Roman Campagna; the encouragement of the cultivation of cereals, of horticulture, arboriculture and motor ploughing. The work of reorganising Societies responsible for hydraulic works, especially those in connetion with sanitation and drainage was aided by the grant of 30 per cent. of the expenses by the Government.

Means of transport were improved by the construction of the network of roads provided by Art. 35 of the law of 1905, with certain modifications.

The exemption from rates and taxes has also favoured the carrying out of improvements. The Commune of Rome has also collaborated in an active manner in the agricultural development of the Campagna.

The present state of the improvements may be summarised as follows:

| *State of Work on the Farms.* | Number | Acreage |
|---|---|---|
| Improvements completed, or nearly so | 118 | 52 865 |
| » advanced | 40 | 31 297 |
| » begun | 25 | 15 591 |
| » not yet begun | 26 | 8 433 |
| | 209 | 108 186 |

It was only necessary in a few cases to sanction expropriation, and the act was never carried out.

To the old Roman Campagna (the so-called "Agro Romano") which comprised 108 186 acres, the extensions provided by the new law including 64 195 acres and the suburbs of Rome comprising 10 290 acres, have to be added, thus forming a total of 182 671 acres under the law for the Improvement of the Roman Campagna.

An appendix is added containing notices on some farms in the recent extensions of the Campagna.

4 – **Investigations in Egypt on *Bilharzia haematobia*, a Parasite of Man,** in *The Journal of Tropical Medicine and Hygiene*, Vol. XVIII, No. 20, pp. 232-234. London, October 15, 1915. RURAL HYGIENE

Hitherto our ideas as to the method of infection by *Bilharzia haematobia* (an internal parasite of man) have been based on the work of Looss. His conclusions that the parasite is communicable directly from man to man by

water only, was a refutation of the earlier belief that the bilharzia worm, like other trematodes, required to undergo a metamorphosis in a molluscan intermediary before it was capable of infecting another person. The investigations of COLONEL R. T. LEIPER, who was entrusted in 1915 with the study of bilharzia disease in Egypt, have now proved this former theory to be the correct one.

Although LOOSS was obliged to conclude that none of the Egyptian mollusca exhibited the slightest attraction for the freshly hatched free-swimming embryos (*miracidia*) of bilharzia, LEIPER found that a definite attraction was exhibited by the following: *Planorbis boissyi*, *Bullinus sp.* (?) *Pyrgophysa forskali*, and *Limnaea truncatula*. The spread of the parasite being therefore limited by the natural geographical distribution of the intermediate host, it follows that the conclusions regarding this disease based on the LOOSS hypothesis have been directly contradicted by the results of the present enquiry. Some of the more important of these are as follows:

(1) Transient collections of water are quite safe after recent contamination.

(2) All permanent collections of water, such as the Nile, canals, marshes and lakes, are potentially dangerous, depending upon the presence of the essential intermediary host.

(3) The removal of infected persons from a given area would have no effect, at least for some months, in reducing the liability to infection, as the intermediate hosts discharge infective agents for a prolonged period.

(4) Infected persons cannot reinfect themselves or spread the disease directly to others. They could only convey the disease to those parts of the world where a local mollusc could efficiently act as carrier.

(5) Infection in towns is acquired from unfiltered water.

(6) Eradication can be effected without the cooperation of infected individuals by destroying the molluscan intermediaries.

The report of the investigations is published in the *Journal of the Royal Army Medical Corps* for July, 1915, and is to be continued.

## CROPS AND CULTIVATION.

AGRICULTURAL METEOROLOGY

5 - **Frost Protection for Fruit and Vegetables in the United States.** — 1. HUMPHREYS, W. J. (Professor of Meteorological Physics, Weather Bureau),: Frost Protection. — *U. S. Department of Agriculture, Weather Bureau, Monthly Weather Review*, Vol. 42, No. 10. Oct. 1914), pp. 562-569, 1 fig., Washington, Feb. 6, 1915. — 2. CARPENTER, FORD A. (Local forecaster,): Utilization of frost warnings in the citrus region near Los-Angeles Cal. — *Ibid.*, pp. 569-571, 23 figs. — 3. SMITH, J. WARREN (Professor of Meteorology, Weather Bureau, Columbus, Ohio): Frost warnings and orchard heating in Ohio. — *Ibid.* pp. 573-583, 15 figs., 9 tables. — 4. MARVIN, CHARLES F. (Chief of Weather Bureau): Air drainage explained. — *Ibid.*, pp. 583-585. — 5. VON HERMANN, CHARLES F. (Section Director): Protection against frost in Georgia. — *Ibid.*, pp. 585-586. — 6. THIESSEN, ALFRED H. (Section Director): Protection from frost in Utah. — *Ibid.* pp. 586-587. —

7. VOORHEES, J. F. (Local Forecaster) : Notes on frost protection in the vicinity of Knoxville, Tenn. — *Ibid.*, p. 587. — 8. BEALS, EDWARD A. (District Forecaster) : Frost forecasts and protection in Oregon, Washington, and Idaho. — *Ibid.*, p. 587. — 9. MITCHELL, ALEXANDER J. (Section Director) : Frost and frost protection in Florida. — *Ibid.*, pp. 588-589. — 10. BRIGGS, ROBERT R. (Section Director) : Frost protection in Arizona. — *Ibid.*, pp. 589-590. — 11. SPRAGUE, MALCOLM (Observer and Acting Section Director) : Frosts and frost protection in Texas. — *Ibid.*, p. 590. — 12. CLINE, JOSEPH I,. (Local Forecaster) : Frost protection by irrigation in southern Texas. — *Ibid.*, pp. 591-592.

I. *Crops liable to damage.* — The two main types of injury to horticultural crops by low temperatures are both exemplified in the United States : thus in the regions in which the average climatic conditions allow of the successful growing of citrus fruits, olives and winter vegetables, the occasional extension of cold spells in winter may result in serious damage to all the green parts, as well as to the fruit of citrus trees, and even in death of the trees ; in the regions of cultivation of fruits resistant to cold during their resting period, the damage is due to the occurrence of frosts in spring after the buds have opened and is generally confined to destruction of the flowers and consequent loss of the season's crop.

In Florida it is noted that citrus fruits can withstand a temperature of 25° F. (— 4° C.) for one or two nights, but a continuation of such temperatures causes damage; on the other hand some vegetables (tomato, beans, potatoes) are damaged by temperatures even slightly above freezing-point. In Ohio the following data are given as to temperatures dangerous for fruit buds:

*Peach* : buds showing pink, 20° F. (—6.6° C.) ; flowers newly opened, 26° F. (—3.3° C.) ; petals beginning to fall, 28° F. (— 2.2° C.,) ; calyx-tubes falling, 32° F. (0° C.).
*Apple* : petals showing, 22° F. (— 5.5° C.); in full flower, 29° F. (— 1.6°C.); young fruit beginning to swell, 32° F. (0° C.).
*Pear* : flowers opening, 28° F. (— 2.2° C.) ; in full flower, 29° F. (— 1.6° C.) ; fruit setting, 30° F. (— 1.1° C.).
*Cherries* in full flower have resisted 28° F. (— 2. 2° C.)

Dormant peach buds have been found dead after the temperature had reached a minimum of —17° F. (—27° C.) in Ohio, while in Georgia many trees have been killed with temperatures below 0° F. (— 18° C.).

II. *Meteorological conditions leading to frost damage.* — Two distinct types of cold weather may be recognized : 1) frost due to radiation with still air and clear sky — characterised by lower temperature and more severe damage on low ground or depressions than on neighbouring slopes and at moderate elevations ; 2) low temperature due to a current of cold air (« norther ») — characterised by more or less regular decrease of temperature with increasing elevation, and often by very low humidity.

Both types cause damage in the citrus districts, while the late spring frosts injuring fruit blossoms, and early autumn frosts damaging vegetables are almost always of the first type.

Dr. MARVIN (Chief of the Weather Bureau) offers a modification of the generally accepted explanation of the phenomenon of vertical inversion of temperature, with the coldest air in the valley bottom and a "thermal

belt" at a certain height on the hillsides. At the end of a fine afternoon, when the convection currents due to the sun's heating have ceased, the whole mass of free air is relatively warm and almost in the adiabatic state (regular decrease of temperature with increasing elevation); during the night this free air will cool only by the slow process of gaseous radiation. But radiation from the soil and the vegetal covering is much more rapid, so that the air in contact with the bottom and sides of the valley is rapidly cooled; the air at the bottom of the valley remains practically where it is getting colder and colder; but up the slopes as soon as cooling causes slight increases in density, a convective exchange takes place between this cooled air and the warmer free air further out, the cooled air moving slowly outwards and slightly downwards while fresh warm air moves in above it to take its place; small circulations of this nature are taking place at all levels. Thus the warm free air facing the slopes acts as a great reservoir of heat, retarding the fall of temperature which would otherwise result from the loss of heat by nocturnal radiation under clear skies. The circulation described also gradually adds to the lake-like mass of cold air filling the bottom of the valley. Higher up the slopes, where the temperature of the free air in the afternoon is lower, a level is reached at which this free air does not contain sufficient heat to prevent the cooling by radiation proceeding to a point below the requirements of particular crops.

III. *Prediction of frost and frost warnings.* — The prediction of cold spells, involving the study of the weather conditions over considerable areas, is naturally the work of the Weather Bureau. In fruit-growing districts, special arrangements are made to furnish warnings of frost as expeditiously as possible to the growers. For the citrus-growing district of California such warnings (varying from "light frost in exposed places" to "killing frost: growers should fire early") are mailed from the Los Angeles office on postcards at 9.30 a. m. to about a thousand addresses; the mid-day editions of the evening papers also print the forecast, while a telephone company distributes it free of charge to all the central offices in southern California. Special warnings are also sent if the morning forecast is too late for the mails or if the conditions change before evening. Thus on January 12, 1913, a high-pressure system spread unexpectedly from the east: warnings were sent out that evening, and on the following morning temperatures from freezing down to 26° F. (—3.3° C.) were reported in various places in the citrus zone. Further, the cooperative associations of orange and lemon growers arrange with the local telephone companies for warnings to be distributed to the individual growers even during the night. For instance the Ontario (Cal.) Frost Protection League secures notification of lemon growers when the temperature falls to 35° F. (+1.6° C.), and orange growers when it reaches 29° F. (—1.6° C.) before midnight or 32° F. (0° C.) at midnight; if there is much humidity this is also stated, as moist air reduces the danger.

Growers unable to receive the warnings are recommended to study the general weather forecasts and learn what types of pressure distribution lead to frosts in their locality. At the same time there are a number of in-

dications for predicting frost either in conjunction with warnings or not. The most important of these are :

1) Evening temperature of 40° F. (4.4° C.) or lower.
2) Clear sky.
3) Wind none or very light.
4) Movement of air, if any, from north-west.
5) Dewpoint below 32° F. (0° C.).

If the moisture of the atmosphere is sufficient to raise the dewpoint above 32° F. further lowering of the temperature will be hindered by the formation of a fog blanket and by the heat of condensation. The dewpoint is most readily determined by the *sling psychrometer* : this consists of two thermometers fastened on a common frame which is connected by means of a short flexible cord, link or chain to a handle by which the whole may be whirled ; the bulb of one of the thermometers is covered with muslin ; when an observation is to be made the muslin cover is saturated with clean water and the apparatus is whirled till the wet-bulb thermometer reaches a constant minimum (usually 2 or 3 minutes are sufficient) ; the difference is read off and the dewpoint determined from specially prepared tables.

With regard to the dewpoint, it must be remembered that changes in air currents may modify it during the night ; this is particularly the case in districts adjacent to mountains or to arid belts, such as the citrus district of California. Observations in the hardy-fruit districts of Ohio, referring to spring frost, show that the dewpoint observation requires correction for different localities, and that when humidity is great the minimum temperature reached will be lower than the evening dewpoint, while with low humidity the minimum will be higher than the dewpoint.

Prof. J. Warren Smith describes a method of predicting the minimum temperature in clear and calm weather from observation of the time of the average *median* temperature ; it seems that the difference between the maximum of the day and the temperature at the average time of the median is very nearly equal to the difference between the latter and the minimum of the following morning. The time of the median for any given locality and date seems to be fairly regular : thus at Columbus, Ohio, the average times for May in 1912, 1913 and 1914 were respectively 8.52, 9.12 and 9.15 p. m. In changeable weather it is useless to try to predict the minimum in this way.

In any case one or more alarm thermometers should be placed in the orchard, set at any desired temperature, so as to give warning in time to make the final preparations for protecting crops.

IV. *Methods of protection against frost* — The methods for preventing damage by frost are as follows :

1) Selection of location little liable to frost.
2) Delay of flowering (hardy fruit-trees).
3) Spraying with water.
4) Irrigation.
5) Smudge burning.
6) Dry heating.
7) Temporary roofing or covering.

1. — Location in the thermal belt is desirable ; a north exposure is

often good in that it ensures slow thawing and also late flowering. In this connection may be mentioned the planting of a close hedge (*e. g.* of *Eucalyptus*) on the upper side of an orchard on low ground with a view to deflecting currents of cold air.

2. — Attempts to delay flowering of fruit-trees have been made by piling ice or snow round the base of the trunk: but it appears that the possible slight delay obtained is not sufficient to justify the expense incurred. In the same way spraying with whitewash seems not worth carrying out for this purpose alone.

3. — Spraying with water may be undertaken in the evening to increase the humidity of the air and thus raise the dewpoint: further experimentation of this method is desirable. It may also be practised in the morning following a sharp frost to decrease the rapidity of thawing, and seems then to be beneficial in reducing damage for both trees and vegetables.

4. — Flooding of the ditches in cranberry bogs has long been practised as a means of warding off a threatened frost; the heat supply of the water prevents the temperature of the surrounding surface air from decreasing nearly so rapidly as it otherwise would. For orchards, there are obvious disadvantages, as that a soil wetted by irrigation would be more subject to subsequent frosts than if left dry. Flooding is also used with success in Texas and Florida to prevent damage to cabbages and other vegetables during spells of sharp frost: in this way cabbages have been able to withstand temperatures as low as 17° F. (— 8.3° C.), when those in unprotected fields were almost completely destroyed. The fields should not be flooded until the near approach of dangerous temperatures and should be drained as soon as the air temperature rises above freezing point.

5. — The presence of a pall or canopy of smoke over an orchard has a considerable effect in checking radiation; the smoke is produced by burning straw, sticks or other rubbish, preferably with the addition of coal-tar. In Georgia the method was formerly practised for protecting peach orchards; twenty to twenty-five fires are necessary per acre.

6. — Dry heating by fires of wood or coal or by heaters burning oil is now part of the regular practice in many citrus and hardy-fruit districts.

In both California and Ohio oil heaters are now the rule. In the citrus district of Los Angeles one 7-gallon pot is put to each tree, with a double row round the exposed side of the grove; the down-draft pots chiefly used will last 6 to 10 years. The equipment costs over $ 180 per acre, with $ 33 per annum for maintenance and deterioration. With these heaters the temperature has been maintained at 12° F. (6.7° C.) above that of the unheated air.

For fruit-trees in Ohio it is recommended that 80 to 120 heaters be used per acre; the oil should be of medium weight, as light oil burns too rapidly and with heavy oil a large amount of soot is deposited on the trees. One man should be able to light the pots on 5 acres in about 2 hours. Reckoning that 100 one-gallon pots per acre burn for 12 hours during the season,

300 or 400 gallons of oil will be required. The initial cost here is reckoned at about $ 50 per acre, with $ 3 to $ 5 for every night that heating is done.

A disadvantage of oil heaters is that the oil dropped in the orchard is decidedly injurious to the trees. They are also liable to be put out by falling snow.

The best coal burners hold 25 to 30 lbs. of coal and will burn for 4 to 6 hours ; with 36 fires to the acre, the temperature of an orchard has been maintained at 9° F. (5° C.) above that of the surrounding air ; with special kindlers lighting is as rapid as with oil heaters, but refilling takes twice as long. In some cases coal fires are arranged on the open ground.

Wood fires require more attention than either oil or coal pots, and must be lighted some time before they are required.

Prof. HUMPHREYS makes the following calculation of the heat required for maintaining the temperature of an orchard.

Let the sky be clear, the dewpoint below 0° C., the surface of the ground horizontal and at 0° C., and a wind enter at one side at 1 metre per second.

Radiation from vegetation and from the ground may be taken at $^1/_{10}$ calory per sq. cm. per minute ; supposing each tree to occupy 100 sq. m., then it will require 6 000 000 calories per hour; now one gram of petroleum produces about 8 500 calories, so each tree would require the combustion of about 860 cc. per hour to prevent cooling by radiation.

Suppose the air entering the orchard to require heating by 2° C. to a height of 12 m ; to warm 1 cu. m. of air 1° C. requires 310 calories, so the amount of heat required per lineal meter of the side at which the air is entering will be $2 \times 12 \times 310 = 7440$ calories per second ; this means the consumption of 3.7 litres of oil per hour.

If these figures are referred to an orchard of 100 hectares (side 1 km.,) we get an hourly consumption of oil as follows :

| | litres |
|---|---|
| To counteract radiation . . . . . | 8 600 |
| To warm the entering air . . . . . | 3 700 |
| Total . . . . | 12 300 |

7. — Covering by screems of cloth or laths is generally only applicable to vegetables, owing to the expense of the frame work for orchards (estimated at $ 200 per acre in a 5-acre lemon orchard in California) ; it is, however, worth while for nurseries of citrus trees. Such methods have the advantage of providing more protection from drying winds than fires.

V. — *Protection in the different States.* — In *Ohio, Oregon, Washington,* and *Idaho,* protection is chiefly required for hardy fruit ; oil pots are most generally used. In *Tennessee* a few orchardists have tried protection and have found soft coal the cheapest heating material.

In *Utah* some growers use oil or coal pots for protecting fruit blossoms but protection is more often applied for the tomato crop in the autumn: in this case smudging is found efficacious, as such early autumn frosts generally occur in still weather. The crop of alfalfa seed is also liable to suffer ; as the seed ripens very irregularly the growers prefer to cut as late as possible so as to get a full yield, but if frost is expected the crop is mown and at once stacked.

In *Georgia* the peach crop is the most important one requiring protection, the number of peach trees in the State in 1910 being over 10 million. The use of smudge fires was quite general by 1898, but a severe freeze in February 1899 (with temperatures below 0° F., — 18° C.) killed many trees and discouraged the growers ; since that date there have been only five seasons in which peaches have given a full crop without protection. Strawberries, tobacco, etc., are often covered with straw, cloth or other material when warnings of frost are received.

In *California* protection is a regular feature for many citrus orchards ; in *Florida* for both citrus fruits and vegetables. In *Arizona* the area under citrus fruits and olives is extending, but not yet large ; both fire pots and spraying are used for protecting the older groves, while nursery stock and young trees are protected by shelters.

In *Texas* winter vegetables and sugarcane are liable to damage ; here the cold spells usually begin with a strong wind, during which heating is of little use without windbreaks ; but the sharpest frost occurs in the second and third nights when the wind has dropped, and then smudge pots or heaters are effective. Flooding is practised in the irrigated districts.

6 – **Agricultural Meteorology in the United States.** — *The Scientific American*, Vol. CXIII, No. 12, p. 245. New York, September 18, 1915.

The U. S. Weather Bureau is now preparing a series of new rainfall charts of the United States for the forthcoming agricultural atlas of that country which is to be issued by the U. S. Department of Agriculture.

These charts will present detailed data of the rainfall over the western states where water supply is of such great importance, but where owing to the scarcity of meteorological stations it was impossible to draw isohyetal lines with reasonable accuracy. The new charts will show the average precipitation in all parts of the country during the 20-year period 1895-1914, all short records being reduced to this period by the usual method of comparison with data from long-record stations. Other charts in this atlas will present data concerning the frequency of droughts, the length of the frostless season etc.

7 – **The Composition of Rain Water at Montevideo, 1909 to 1912.** — SCHROEDER, J. in *Revista de la Asociación Rural del Uruguay*, Year XIV, No. 7, pp. 381-391. Montevideo. July 1915.

The analyses of the rain water at Montevideo (Agronomic Institute, Sayago) during the period 1909-1912 support the following conclusions:

1) An annual rainfall of 1504 mm. (1912) contributed to the experimental field at Sayaog 6.8645 lbs of combined nitrogen per acre, of which 3.2752 was in the form of ammonia and 3.5873 lbs in the form of nitroso-nitric compounds ; during a period of two years the quantity of ammoniacal nitrogen brought down was 6.052 lbs and the nitroso-nitric nitrogen 6.078 lbs making a total of 12.130 lbs or an average of 6.065 lbs per acre per annum. These figures do not exceed by much those of temperate and sub-tropical zones.

2) The amount of sodium chloride carried by the rainfall is 73.4 lbs

per acre per annum; the percentage of chlorine in rain appears to depend on the direction of the winds during the rainfall.

3) The quantity of organic matter in rain water determined in terms of the amount of oxygen required to oxidise it, averages 750 mg. of oxygen per 1000 litres.

4) The total residue on evaporation averages 303 lbs per acre per annum, of which 108 lbs disappeared on calcination leaving 195 lbs of non volatile matter.

These figures relate to the above mentioned locality and the writer hopes that similar studies will be extended to all part of South America.



8 - **Effect of Temperature on Movement of Water Vapour and Capillary Moisture in Soils.** — Bouyoucos, G. J. (Research Soil Physicist, Michigan Agricultural Experiment Station) in *Journal of Agricultural Research*, Vol. V, Part 4, pp. 141-172. Washington, October 25, 1915.

The diurnal change of temperature gradient of the soil gives rise to a change in surface tension and viscosity of the soil moisture, and since capillary action is dependent upon surface tension and facility of movement upon viscosity there should occur an upward and downward movement of soil moisture corresponding to the diurnal changes in temperature gradient. Thus, during the day when the temperature of the soil is highest at the surface and diminishes with depth the surface tension and viscosity of soil moisture will be lowest at the surface and will increase with depth, consequently the movement of moisture should be downward. During the night conditions are reversed and hence the water translocation should be upward.

The object of these investigations was to determine the validity of these deductions. The method of procedure consisted in placing soils of different but uniform moisture content in brass tubes 8 inches long and 1 ½ inches in diameter closing both ends with solid rubber stoppers and keeping one half of the soil column at a high temperature and the other half at a low temperature for a certain length of time, then determining the percentage of moisture of the two columns, any difference in water content being attributed to thermal translocation. The movement of moisture from warm to cold soil was studied with the column in a horizontal and also in a vertical position.

It was found that when the same percentages of moisture were employed practically the same results were obtained whether the tubes were placed horizontally or vertically. When one half of the soil column is maintained at a temperature of 20° or 40° C. and the other half at 0° for eight hours the percentage of water moved from the warm to the cold soil increased with increase in water content in all the different types of soil up to a certain point after which it decreased with further increase in the water content of the soil. The moisture content at which the maximum thermal translocation of water occurred is different for different soils but the percentage of water transferred is the same for all classes of soil for any one of the temperature amplitudes. The percentage of moisture at which

the maximum thermal translocation occurs is known as the "thermal critical moisture content."

These results being contrary to expectation, it is therefore concluded that the capillary movement of water in moist soils is not controlled entirely by the curvature of the capillary films as is generally believed, but also by the unsatisfied attractive forces of the soil for water.

The possibility of thermal movement of soil moisture occurring by evaporation and condensation was then investigated. The formation of dew is attributed to the rising of vapour or moist air from the warmer soil below to the colder soil above where it is condensed. To test this possibility the tubes were filled with soil so as to leave a column of air in the middle portion. One half contained moist soil at temperatures of 20° and 40° and the other half dry soil at a temperature of 0°. The percentage of moisture distilled over from the moist warm soil to the cold dry soil in 8 hours was insignificant for both amplitudes of temperature and was about the same for all moisture contents.

It is therefore concluded that the amount of water lost from the soil in the form of vapour is very small, that there is no rising of vapour during the night from the warmer soil below to the cold soil above and that the water of the dew is not derived from the soil vapour, as is commonly believed.

A dry layer of soil is often used as a mulch to reduce the evaporation of water from the subsoil. This action is attributed to the break in the capillary connections between the surface layer and moist soil below. Since the adhesive and absorptive forces of a solid substance decrease with rise of temperature the question arises as to whether the dry mulch with a high temperature would absorb moisture from a moist soil at a low temperature even when the capillary connections were ideal. To investigate this point brass tubes were filled with soil, one half with dry and the other half with moist soil with a circular piece of cheese cloth between to facilitate their separation. When the moist column was kept at temperatures of 20° and 40° C and the dry column at 0° for 8 hours the amount of moisture moved from the moist warm soil to the dry cold soil increased with temperature and moisture content. But when the moist soil was kept at 0° and the dry soil at 20° and 40° little if any movement of water occurred. It is therefore concluded that temperature has a very marked influence on the conservation of moisture by mulches. A high temperature promotes the formation of a mulch and tends to conserve the soil moisture in the deeper layers.

9 - **Soil Temperatures as Influenced by Cultural Methods.** — OSKAMP, JOSEPH (Research Assistant in Pomology, Purdue University Agricultural Experiment Station) in *Journal of Agricultural Research*, Vol. V, No. 4, pp. 173-179, fig. 1-4. Washington, D. C., October 25, 1915.

The following data have been obtained during a period of two years on three plots in a young apple orchard, as follows: 1) tillage with cover crop; 2) straw mulch, and 3) grass land.

The temperatures were recorded automatically by means of soil thermographs. The thermometer bulbs were planted 5 or 6 feet north east of each tree and at a depth of 9 inches. On the straw-mulch plot the bulb was placed 12 inches below the surface of the mulch. The plots are situated on a glaciated, rough, river bluff, upland soil in Southern Indiana, consisting of a clay silt.

Plot A received clean cultivation with a rye cover crop sown in late summer and turned under in the spring to a depth of 7 inches. The land was cultivated 7 times each season.

Plot B was in grass which was cut and allowed to lie where it fell and a mulch of wheat straw was applied at the rate of 1 bale (93 lbs) per tree.

Plot C was in grass which was cut and allowed to lie where it fell as in plot B. It may be considered as timothy meadow land.

Plot A maintained the highest maximum temperature during the spring and summer and until quite cold weather in the fall, when plot B registered the highest maximum temperature. This lasted a month or more during the coldest weather but in late winter plot A warmed up rapidly, followed by plot C.

The greatest variation between plots occurred during the summer months. In the spring and autumn there is a transition period in which the temperatures differences are less. The maximum temperatures recorded are Plot A, 80.5 F. Plot B. 71° F and Plot C. 78.5 (July). During the winter the temperatures are quite constant from day to day with little variation between the plots. In the spring the diurnal range is considerable in the plot under tillage with cover crop and the grass land, but varies little under the straw mulch which shows a gradually warming up. During the summer season, fluctuations become quite pronounced under tillage and grass, but the straw mulch still maintains its uniformity. The daily maximum and minimum temperatures occur about 10 p. m. and 10 a. m. respectively.

In conclusion it may be said that a system of clean cultivation with a winter cover crop is characterised by extreme diurnal and annual fluctuations in soil temperature, that a straw mulch equalised these fluctuations to a marked extent, as does also a grass crop, though in a less degree.

10 – **Effect of Fertilizers on the Physical Properties of Hawaiian Soils.** — Mc. George, W. *Hawaii Agricultural Experiment Station*, Bull. No. 38, pp. 31, figs. 3. Washington, 1915.

This bulletin contains data obtained from an extensive study of the physical properties of Hawaiian soils and the effect of fertilizers upon these properties. It is evident that agents which influence the mechanical condition are many and complex. It has also been clearly demonstrated that the addition of salts or fertilising materials affects the structure of the soil. It is impossible to predict in all cases the degree to which any one or all physical properties will be influenced by the addition of a fertilizer, since this depends primarily upon the mechanical composition of the soil, the nature of the organic matter, and probably upon certain factors which are at present unknown. However, within certain limits, the effect of

adding a larger application of a salt only magnifics that of a smaller application. This suggests that the measurement of the physical effects may be just as accurately, and possibly more accurately, determined than the chemical effect. The measurement of a normal application of fertilizers through a chemical analysis of the soil is practically impossible.

Capillarity is diminished in clay soils by the addition of salts but increased in sandy soils. Also this property is more active in silts than in sandy or clay soils, being slowest in the latter. The percolation of water is most rapid in sandy soils and slowest in types the particles of which are most likely to swell. Fertilisers considerably increase the resistance to percolation. The theory that soils of greater capillary activity offer the least resistance to percolation does not apply to Hawaiian soils.

Salts increase or diminish the size of the soil aggregates. This is of no small importance in the use of fertilisers. The cohesion of the soil particles in most instances is increased by the addition of salts. This is also true of the apparent specific gravity. However, there are too many exceptions to make any definite statement.

The hygroscopic moisture is increased by the addition of salts, with but very few exceptions. The vapour pressure is lowered in most instances, but can not be explained from a consideration of the surface tension of the added salts.

11 – **The Humification of Plant Constituents.** — TROUSOR, A. (from the Agronomic Laboratory of the University of Petrograd) in *Selskoie Khosiaistvo i Liesovodstvo* (Agriculture and Sylviculture), Vol. CCXLVIII, pp. 409-437. Petrograd, July 1915.

After reviewing his own work on the causes of the formation of humus from the constituents of plant organisms (1) the writer describes his experiments on the factors upon which humification depends.

From the results of these experiments the following conclusions are drawn:

1) Humification of vegetable products is effected not only by purely chemical means (oxidation and action of alkalis) but also biologically (bacteria and fungi). The humification of lignin is effected by oxidation, and the action of alkali and fungi. Protein substances are humified under the action of bacteria, whilst tannins and chlorophyll are humified by oxidation and alkalis.

2) The conditions favourable to humification are good aeration and a suitable temperature. The latter exerts considerable influence : the decomposition of proteins and starch at a relatively low temperature (8°-10° C.) does not result in the formation of humus, whilst at high temperatures (37°-38°) humus is readily formed. Further the quantity of lignin transformed into humus is greater at high temperatures than at low ones.

3) The rapidity of humification of the various constituents of plants varies. Lignin, tannins and chlorophyll humify rapidly whilst proteins humify slowly and starch still slower.

(1) See *B.* April 1915 No. 377 and Nov. 1123. (*Ed.*).

The writer has also studied the actual humification of plant constituents in the soil.

Immediately after the vegetable matter reaches the soil humification begins before decomposition sets in, with the constituents washed out by the rain into the soil.

The soluble matter of the undecomposed woody tissue, removed by the rain, takes a very active part in the formation of humus. These soluble humic substances are formed by the decomposition of proteids (albumen but not proteins), tannins and chlorophyll, whilst humic substances are only formed from lignin by decomposition in the presence of albumen.

Thus, since the water soluble substances become fixed in the soil, the formation of humus in the soil involves the lignin, protein substances and other constituents classed by the writer as " sources of humus ".

81 – **The Punjab Triple Canal System.** — BENTON, Sir JOHN. in *Engineering*, Vol. C, No. 2603, p. 515. London, November 19, 1915.

PERMANENT IMPROVEMENTS. DRAINAGE AND IRRIGATION

The Punjab or " Land of the five waters " in the North-West of India is traversed by the Suttlej, Besa, Ravi, Chenab and Jhelum rivers which rise in the Himalayas and flow into the Indus. The tracts between these rivers are known as the " Doabs " or " two waters ".

The Punjab soil is rich alluvium and the configuration of the ground is admirably adapted for irrigation. A certain number of irrigation canals have already been constructed and in thirty years the irrigated area increased from 2 ½ to 7 ½ million acres, while the returns on the capital expended rose from nothing to over 15 per cent.

The position was that in the east of Central Punjab, in the Lower Bari Doab there was a tract of 1 ½ million acres of excellent arid waste land, which owing to previous utilisations had no near water supply available, while on the western side there was a large unutilised perennial supply in the Jhelum River. The utilisation of the plethora of water on the west for the irrigation of the plethora of land in the east involved carrying the surplus across two great and widely separated rivers, namely the Chenab and Ravi, and also across numerous formidable hill torrents.

The final scheme consisted in the construction of three large, separate, and interconnected canals for the irrigation of the Upper Jech, Upper Rechna and Lower Bari Doabs.

The aggregate areas are as follows :

| | Acres | Acres |
|---|---|---|
| Gross commanded area . . . . . | | 3 997 434 |
| Proposed irrigation in karif (April to September) crops . . . . . | 937 928 | |
| Proposed irrigation in rabi (October to March) crops . . . . . | 937 927 | |
| | | 1 875 855 |

In calculating the required water supply, the absorption and evaporation in the canals — on the bases of experience — were assumed to be 8 cub.

ft. per second per million square feet of wetted area of these channels while the average supplies—on the same bases—were assumed to be for:

*Kharif*, 1 cub. ft per second for 100 acres of irrigation.

*Rabi*, one half the above amount.

The works comprise a great regulator for the Upper Jhelum Canal, head works at the Upper Chenab Canal and those of the Lower Bari Doab Canal. The objects of the latter being the passing of 6750 cub. ft. per sec. from the tail of the Upper Chenab Canal over the River Ravi while at the same time admitting of supply being drawn from that river when available, this results in these works including an inlet and fall for the Upper Chenab Canal on the right bank, a barrage for the river with thirty five bays of 40 ft. span, with steel gates and a head regulator for the Lower Bari Doab Canal on the left bank. The entire work for the triple system comprises about 22 645 miles of channels.

The whole of the Upper Jhelum Canal is unavoidably constructed across the drainage of a very heavy rainfall. The total amount of cross drainage is estimated at about 604 000 cusecs and sixty-two works have been constructed for the passage of this disharge.

One of these canals was opened in 1912, the other two in 1913 and 1914.

Charges for water are made on the area irrigated and irrespective of the quantity of water used. The average water rates, direct and indirect, vary from 6*s* 6*d* to 7*s* per acre. The estimated cost of the works amounts to £6 912 132 with a net revenue of £518 550 or 7 ½ per cent, and if the irrigation area reaches 2 000 000 acres as expected, the return on the capital cost will become 8 per cent.

MANURES AND MANURING

13 – **Half Yearly Review of the International Movement of Chemical Fertilisers.** — *Bulletin of Agricultural and Commercial Statistics*, Year VI, No. 9, pp. 499-532, International Institute of Agriculture, Bureau of Statistics. Rome, September, 1915.

Conforming to a decision of the Permanent Committee, this review, of which the first two numbers have appeared in this *Bulletin*, (September 1914 and March 1915) is published in the Bulletin of Agricultural and Commercial Statistics of the Bureau of Statistics beginning from September 1915.

The " Annuaire de Statistique agricole et commerciale 1913 and 1914 " published by the same Bureau also contains the data relating to the worlds' statistics of chemical fertilisers.

14 – **Some Factors Affecting the Efficiency of Phosphates difficultly Soluble.** — SÖDERBAUM, H. G. in *Kingl. Landbruks Akademiens Handlingar och Tidskrift*, Year L, No. 5, pp. 448-467, 7 figs, 9 plates. Stockholm, 1915.

Previous workers have shown that the fertilising value of insoluble phosphates (bone meal, tricalcium phosphate, phosphorite, etc.) depends largely on the quantity of lime contained in the soil. A more detailed experimental enquiry into this problem soon gave numerous results showing the existence of other factors of a nature hitherto unexplained, capable of diminishing or increasing the efficiency of insoluble phosphates and also perhaps of phosphates in general. The attendant factors affecting growth were considered to be: partly the form of the nitrogenous manure added at the

same time, partly the amount of magnesia in the soil and its relation to the amount of lime and phosphoric acid present. These factors are considered as the *nitrogen factor* and *magnesium factor*.

To determine the influence of these two factors, under various condition, on the yield of the crop, 10 years experiments have been made with oats, barley, rye and wheat in a sandy soil ("Diluvialsand") sufficiently poor in nitrogen and phosphoric acid. The crops were grown in glass vessels containing from 52 to 66 lbs. of the soil. The results obtained showed that: replacing nitrate of soda by ammonium salts (nitrate or sulphate) gave quite different results according as the added phosphate was soluble or insoluble. In the first case when the phosphoric acid was added as superphosphate, basic slag or bicalcium phosphate the change of nitrogenous manure did not cause much difference in the results. In the greater number of cases a slight depression was observed and in one case only a slight increase in yield.

When the phosphate applied was in the insoluble condition the results were quite different. Replacing nitrate of soda by ammonium salts caused without exception a more or less great increase in the yield of oats, rye and wheat. With barley however no increase in yield was observed, but more often a decrease which reached a maximum with the exclusive use of ammonium salts (*i. e.* in absence of nitrates). Compared with ammonium salts, organic nitrogen (as urea and albumen) produced less marked effects. The singular behaviour of barley was also evident in this case. Thus, whilst urea applied to oats in place of nitrate gave only a slight increase or none at all, in the case of barley there was a distinct decrease in the yield.

Matters were somewhat more complex when the magnesium factor was modified (by the addition of sulphate or carbonate of magnesia). With soluble phosphates, irrespective of the nitrogenous manure, the addition of magnesium sulphate when it produced any effect sometimes caused a decrease and sometimes an increase in yield.

No definite or marked effect in any one direction could be observed. When, on the contrary, rye or wheat was manured with superphosphate or sulphate of ammonia the addition of equivalent quantities of magnesium carbonate to one or another of the ammonium salts caused a considerable increase in yield. With insoluble phosphate, sulphate of magnesia, in all cases where action occurred, either increased or decreased the yield, whilst carbonate of magnesia applied with ammonium salts always favoured the growth of winter cereals, at least when the ammonia was added as sulphate.

From these experiments and those of previous workers the following practical conclusion may be drawn: When phosphoric acid is applied as superphosphate, basic slag or bicalcic phosphate, the replacement of nitrate of soda with sulphate of ammonia apparently produces no appreciable advantage. When however tricalcic phosphate, bone meal, and phosphorite are applied with ammonium salts much better results are generally obtained than when applied with nitrate of soda. These differences which are considerable in pot cultures would also be apparent on a large scale.

The results seem to show also that the fertilising action of insoluble phos-

phates depends also on the amount of magnesia in the soil, an excess or deficiency of which is equally injurious in this respect. In one field the addition of magnesium salts may be very beneficial whilst in another the yield may be considerably diminished. The various crops, either of the same or of different families appeared to have a very different sensibility relative to the variation in the amount of magnesium. It is therefore necessary to make preliminary experiments in the field of a local nature to determine in each case the magnesium requirements of a given plant in any particular soil before a magnesium manure can be recommended.

In every case the consideration of the lime factor cannot be regarded as sufficient when insoluble phosphates are applied. The *nitrogen* and *magnesium* factors must also be taken into account. By a consideration of all three factors it is possible to increase the fertilising value of the phosphates in question by rendering them equal to or less inferior to soluble phosphates.

15 – **Potassium Salts: An Economic Geological Study.** — HERIOT, C. M. in *The Engineering and Mining Journal*, Vol. C, No. 17-18, pp. 669-672 and 712-714, 4 figs. New York, October 23 and 30, 1915.

Considering the vital importance of potash salts at the present time, the writer examines the occurrence of large deposits of potash salts, especially the characters of those of Stassfurt, Hanover and Alsace and argues as to the possibility of discovering new deposits. The principal conclusion of his studies are :

1) The only notable sources of potash salts at the present time consist of stratified marine deposits of the tertiary period or earlier ;

2) The discovery of similar deposits is not improbable provided the search is made in the localities indicated and at sufficiently great depth, remembering that up to the present potash salts, outside of known areas have been found by chance ;

3) The present consumption of potash salts represents only a small portion of the worlds' requirements.

4) For these reasons governments should offer special facilities for prospecting.

16 – **Potash from Kelp.** — CAMERON, F. K. (In Charge Chemical, Physical and Fertiliser Investigations) in *U. S. Department of Agriculture, Office of Secretary, Report* No. 100, (Contributions from Bureau of Soils) pp. 122, fig. 2, plates I-XL. Washington, D. C., April 10, 1915.

This report consist of five parts :

I. Pacific Kelp Beds as a Source of Potassium Salts (F. K. Cameron) ; — II. The Kelp Beds from Lower California to Puget Sound (W. C. Crandall) ; — III. The Kelp Beds of Puget Sound (G. B. Rigg) ; — IV The Kelp Beds of South-east Alaska (T. C. Frye) ; — V. The Kelp Beds of Western Alaska (G. B. Rigg) ; giving the results of an accurate survey of all the kelp beds of commercial importance between Cedros Island to Cape Flattery, about half the available supplies of Scutheastern Alaska and the greater part of the beds of the southern coast of the same peninsula.

From the numerous analyses made it appears that the kelps of the Pa-

cific coasts of North America contain about 16 per cent. of potash corresponding approximately to 25 per cent of potassium chloride. The areas and contents of the kelp beds of this coast are as follows :

| Region. | Area Sq. miles | Fresh kelp. tons | Potassium chloride tons |
|---|---|---|---|
| From Cedros Island to San Diego . . . . | 91.36 | 16 979 800 | 649 000 |
| From San Diego to Point Conception . . . | 97.92 | 18 195 300 | 696 000 |
| From Point Conception to Cape Hattery . | 36.24 | 4 377 400 | 167 000 |
| Puget Sound. . . . . | 5.00 | 520 000 | 20 000 |
| Alaska, south east . . . . . | 70.78 | 7 833 000 | 299 000 |
| » » (calculated) . . . . . | 70.78 | 7 833 000 | 299 000 |
| » western. . . . . | 17.86 | 3 567 000 | 136 000 |
| | 389.94 | 59 305 500 | 2 226 000 |

No figures are given as to the cost of production of the pure potassium chloride from kelp, since sufficient experiments have not yet been carried out to permit precise data. Theoretically it should be more practicable to extract potassium chloride from kelp than from the Stassfurt deposits, but there is the cost of collecting the kelp and of the subsequent manipulation which at present is too speculative. The possibility of a profit in the production of potassium chloride, iodine and other products is entirely theoretical, but considering the proportion of potassium chloride (25 per cent.), of nitrogen (2 per cent) and a small amount of phosphoric acid it seems probable that kelp in the dried state either alone or mixed with other substances : fish manure or phosphates, is in the most suitable form to be put on the market. An economic valuation of the above deposits is therefore not trustworthy. Supposing however that all the potassium chloride could be extracted and sold, it would represent a value of more than $ 90 000 000 at present prices, whilst the dried kelp valued on the current prices per unit of potash and nitrogen would realise more than $ 150,000,000.

From an industrial point of view, three factors dominate the attitude of capitalists towards the development of the algal beds, *viz* : *a*) the control of the deposits from the point of view of competition ; *b*) the expenses of manipulation which can only be determined by experiments on a large scale ; *c*) the situation, character and extent of the formations with regard to the means of transport by sea and the yield.

17 — **Control of the Importation, Manufacture and Sale of Chemical Manures in Portugal.** (Decreto No 1:946, approvando a organização dos servicios fiscais da importação, fabricação e venda dos adubos agricolas). *Ministerio de Fomento, Direcão General de Agricultura Repartição Tecnica, Seccão dos Servicios Agricolas, Diário de Gôverno* Series I, No. 206, pp 1104-1109. Lisbon, October 12, 1915.

A Decree dated October 2, 1915 approves the Order relating to the organisation of the Customs services for the control of the importation, manufacture and sale of chemical manures in Portugal and neighbouring islands.

This Order was framed with regard to the necessity for most of the agricultural land in Portugal, of being manured so as to give remunerative results (1) and to the fact that manures on the markets are not always as indicated. The present Decree refers further to the clauses of the earlier decree dated December 9, 1898 which is abrogated.

The Order provides among other things that chemical manures cannot be imported, manufactured or sold in the above mentioned areas except by annual authorisation granted by the Ministry " do Fomento " through the intermediary of the General Direction of Agriculture (Art. 2). A list of manures to be imported, manufactured or sold will be prepared by a technical Commission nominated by the Ministry, and published the first week of each year in the *Diario do Govêrno*. This table will fix the minimum composition and guarantee the chemical composition and degree of availability of the manures. It will be revised each year and pubished the first week of January, in the event of its not appearing the list of the previous year will remain in force. If required it may even be amended during the year. The importation of simple chemical manures for experimental purposes is permitted by special authorization (Art. 3). The execution of the provisions of the decree is entrusted to an agricultural expert in each district, to the above mentioned Technical Commission for chemical manures and dependent chemical laboratories (Art. 4). The remainder of the 31 articles comprise details relative to the execution of the decree which comes into force 60 days after publication in Portugal and immediately on its arrival in the adjacent islands.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS

18 – **The Occurrence of Haematoid Compounds of Iron in Plants.** — II. (2) GOLA, G. in *Atti della Reale Accademia dei Lincei*, Series V, Rendiconti, Vol. XXIV, Part 6, pp. 289-294. Rome, October 10, 1915.

The presence of protein matter in raw vegetable extract prevents the preparation of pure compounds of iron haematoids. To overcome this difficulty the writer makes use of picric acid which has the property of forming with proteins compounds soluble in various neutral organic solvents. The following observations were made :

The examination of a large number of plants of varied types including both cryptogams and phanerogams, shows that they generally contain organic iron compounds having the following properties: soluble in acqueous

(1) See Le Mouvement international des engrais chimiques No. 2, in *B.* March 1915, pp. 368-369. (*Ed*).

(2) See *B.* Oct. 1915, No. 1012. (*Ed.*).

alkaline solutions, in piridine after breaking down the protein molecules, insoluble in dilute acids, form picrates soluble in neutral solvents, separation of iron on treatment with hot alkali solution, resistant to hot acid solutions and also to hot alkalis at a temperature of 240° C.

From these data it is concluded that the iron in its organic form shows a degree of stability such as has been observed hitherto only in the case of haematin compounds of the blood.

Other properties are : react with hot hydrochloric acid in alcohol forming iron compounds with some of the characters of haemin only in the absence of alkali, form compounds with pyrrolic acid : From the foregoing facts it is concluded that there exist in plants compounds of iron chemically and biologically similar to those characterising the blood of many animals.

The writer considers that the ferriferous nucleo-proteins extracted from barley by PICTET, the compound analogous to haematogen studied by STOKLASA in the onion, the compound extracted by TARBOURIECH and SOGET from *Rumex obtusifolius* may possible be ascribed to the same body or groups of haematic bodies investigated by him.

19 – **The Localisation of Acids and Sugars in Fleshy Fruits.** — DEMOUSSEY, E., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 161, No. 15, pp. 443-445. Paris, October 11, 1915.

The writer has analysed the juice obtained by subjecting fruits to increasing degrees of pressure and fractionating the liquid expressed. A hand-press was used, the fruits being placed in a cloth.

The following table gives the principal results obtained :

| Fruit | Acidity per 100 cc. of juice (in gms. malic acid) | | | | Sugars in gms. per 100 cc. of juice | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | reducing sugars | | | non-reducing sugars | | |
| *Pressings* | 1. | 2. | 4. | 6. | 1. | 4. | 6. | 1. | 4. | 6. |
| Purple plums | 0.24 | 0.88 | 1.34 | 1.61 | — | — | — | — | — | — |
| Purple plums | 0.41 | — | 1.48 | 1.54 | 1.43 | 2.36 | 2.89 | 11.09 | 7.87 | 7.03 |
| Greengages, under ripe | 0.51 | 1.04 | 1.25 | 1.30 | 1.49 | 2.31 | 2.57 | 9.81 | 7.37 | 7.34 |
| Greengages, very ripe | 0.16 | 0.75 | 0.85 | 0.84 | 2.34 | 3.82 | 4.63 | 14.13 | 10.07 | 9.96 |
| Apricots | 0.51 | — | — | 1.34 | 1.84 | — | 3.94 | 16.93 | — | 12.37 |
| Peaches, under ripe | 0.79 | 0.90 | 0.96 | — | 2.54 | 2.63 | — | 5.59 | 5.17 | — |
| Peaches, very ripe | 0.35 | 0.39 | 0.40 | 0.42 | 1.87 | — | 2.22 | 8.01 | — | 7.89 |
| Grapes, under ripe | 0.47 | 0.63 | 0.76 | 0.85 | 10.08 | 9.00 | 8.88 | 0 | 0 | 0 |
| Grapes, very ripe | 0.16 | — | — | 0.33 | 19.08 | — | 18.96 | 0 | — | 0 |
| Strawberries | 0.66 | — | — | 0.66 | 4.47 | — | 4.50 | 1.73 | — | 1.75 |
| Melons | 0.01 | — | — | 0.01 | 2.43 | — | 2.46 | 4.28 | — | 4.30 |
| Cherries | 1.17 | 0.94 | — | 0.94 | 16.08 | — | 15.84 | — | — | — |
| Tomatoes | 0.44 | 0.24 | 0.21 | 0.21 | 4.07 | — | 3.55 | 0.05 | — | 1.05 |

The acidity, as is seen, is often subject to considerable variation; the differences in the sugar content are relatively less. It follows that the cells which offer the least mechanical resistance and the greatest permeability have not the same composition as those furnishing the sugars. The difference in their physical structure, probably variation in thickness of their walls, is accompanied by a difference in the chemical composition of their contents. There is localisation, but the trend of variation is not the same for all the fruits. Sometimes it is the least resistant cells that are poorest in acids and in reducing sugars and richest in saccharose, and at other times the reverse is the case; it cannot however be said that it is the same cells which contain both acids and sugars.

The composition of a fruit thus varies from one part to another of its mass, notwithstanding its apparent homogeneity and consistency of its water content; the semipermeability of the protoplasm prevents the free diffusion of the dissolved substances. This localisation of dissolved substances explains the curious fact that certain fruits are more acid after cooking than when raw. Analysis shows, also, that by crushing them cold, as acid a juice is obtained as by boiling. It is therefore not a case of acidification due to cooking, or of fermentation or oxidation, but simply of the disassociation of those cells of which the solutions have a higher acid content.

20 – **The Tyrosinase of the Potato and Sugar Beet.** — GONNERMANN, M., in *Die Deutsche Zuckerindustrie*, Year 40, No. 45, pp. 751-752. Berlin, November 5, 1915.

Several years ago, the writer found in the potato and sugar-beet a tyrosinase which had the property of imparting a dark colour to the sap of the root or tuber. Recently, he has tried to determine whether the tyrosinase of the potato (which had been kept for 14 years dissolved in glycerine) also contained a saponin which is able to haemolyse the red corpuscles of the blood. The glycerine solution was diluted with distilled water and the tyrosinase precipitated by means of alcohol. On filtration, a grey substance was obtained, readily soluble in water. Part of this substance was dissolved in a physiological solution of common salt (0.9 per cent) and one drop of red corpuscles from the blood of a lamb was added to the solution. A black consistent mass due to the agglutination of the red corpuscles, was formed in the vessel. The writer therefore concluded that the tyrosinase of the potato has an agglutinating effect on red blood-corpuscles, but probably does not contain saponin. This experiment, which was repeated with the blood of various animals (lamb, fowl, man) always gave the same result, provided the tyrosinase used was not too dilute.

A second series of experiments was carried out in a similar manner, with the object of determining whether the tyrosinase present in beetroots contains a saponin. It was found that the effect of this tyrosinase was not to agglutinate but to destroy the red blood corpuscles, this effect being due to the presence of a saponin.

21 – **Chemical Composition of the Kernels of the Cherry-Laurel.** — BRIDEL, MARC, in *Journal de Pharmacie et de Chimie*, Year 107, Series 7, Vol XII, No. 8, pp. 249-252. Paris October 1915.

In determining the chemical composition of the kernels of the cherry laurel (*Prunus Laurocerasus* L.) the writer has made use of the biochemical method devised by M. Em. Bourquelot. He draws the following conclusions : the kernels of the cherry-laurel contain saccharose and amygdalin ; 19.2 per cent more of this latter, which is easily extracted is present than in the case of the bitter almond. The leaves of this tree contain a hydrocyanic glucoside derived from racemic phenylglycolic acid, while the kernels contain a hydrocyanic bioside derived from dextro-phenylglycolic acid.

22 – **Recent Researches on the Chemical and Histological Characters of Radishes Cultivated in the Presence of Sugars** (1). — MOLLIARD, MARIN, in *Revue Générale de Botanique*, Vol. 27, No. 318. pp. 161-168. Paris, June 15, 1915.

Sugars placed directly at the disposal of the roots of a higher plant are capable, when used in sufficient concentration, of modifying the reserve substances of the plant, while at the same time a whole series of morphological characters undergo important changes.

The recent researches of the writer were carried out on radishes ; some were grown in a cold greenhouse or in the open ground under ordinary conditions, while others were grown aseptically in tubes containing pumice soaked with a nutritive solution to which was added either 5 or 10 per cent of glucose or 10 or 15 per cent of saccharose. In another series of experiments cultures were made in the presence of 10 per cent of glucose in tubes sealed hermetically by a sterilised rubber cork ; under these conditions, the suppression of chlorophyll assimilation entailed a greater absorption of sugar.

Analysis of the leaves and roots shows regular increase in the amount of sugars and of starch with the concentration of sugar in the nutritive solution. The amount of starch (11 per cent) formed in roots grown in the presence of 15 per cent of saccharose is similar to that found in potato tubers. The ratio of soluble nitrogen to total nitrogen increases, although slowly, with the quantity of sugar absorbed ; there is, however, no proportionality between the two phenomena.

The histological characters of the radish roots show a transformation in the cells; according to the nutritive conditions, these show cell-walls lignified or thin and composed of cellulose ; in the latter case, the parenchyma cells form a reserve tissue. This possible alternative differentiation of the same cell has already been mentioned by CONSTANTIN and is now explained as the result of the amount of sugar that reaches the cell under consideration.

(1) See also *B.* Dec. 1915, No. 1278. (*Ed.*).

23 – **The Index of Foliar Transpiring Power as an Indicator of Permanent Wilting in Plants** (1). — BAKKE, A. L. (Iowa State College, Ames, Iowa) in *The Botanical Gazette*, Vol. LX, No. 4, pp. 314-319. Chicago Ill., October 1915.

In these experiments the progress of wilting in sunflower plants was investigated by means of the cobalt chloride method of determining the index of transpiring power.

The plants were removed from the soil before noon and allowed to wilt in the laboratory at a temperature of about 32° C. Determinations of the index of transpiring power for both the upper and lower leaf surfaces were made at hourly intervals, the first determination just preceding the lifting of the plant.

Five leaves of different ages were employed and the results of the observations averaged for each time.

Wilting began almost immediately after the removal of the plant from the soil and the indices decreased rapidly during the first hour, then more gradually until the fifth hour after which a marked increase occurred. This increase lasted two hours when a decrease again set in.

The increase in the transpiration index after the fifth hour is interpreted as indicating the breaking of the water columns in the vascular tissue thus removing the tensile strain from the leaf cells. After this period no more water could pass from the stem to the leaves, so that the latter gradually dried out resulting in the diminished transpiration recorded.

It is therefore highly probable that this rupture of the water columns represents the critical stage of most intense wilting before permanent wilting begins. Thus the determination of the minimum foliar transpiring power by means of cobalt paper may furnish a precise criterion for the determination of that state of plants vaguely known as permanent wilting.

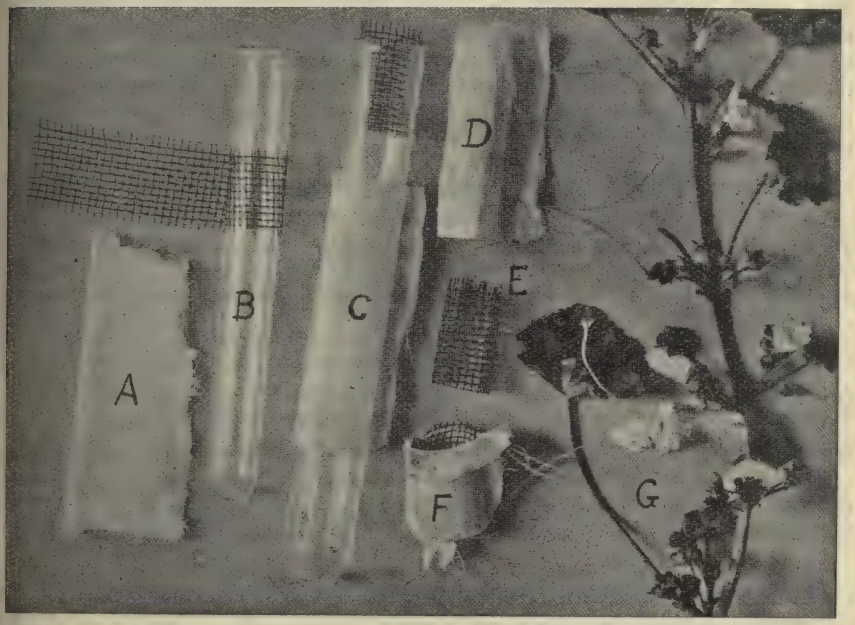
24 – **Protecting Pollinated Blossoms.** — CHAPIN, WILLIAM S. in *The Journal of Heredity*, Vol. VI. No. 10, pp. 471-472, 1 fig. Washington, October 1915.

In cross pollinating flowers, it is often necessary to visit a blossom twice : the first time to remove the pollen from the flower and a second time when the stigmas are in a receptive condition, to apply the pollen from some other plant. The protection of the flower during this work is usually effected by enclosing the flower in a cloth or paper sac. Removing these sacs and replacing them without injuring delicate flowers is sometimes a little difficult. The writer describes a device which he has found very convenient for the ease with which it may be opened or closed without danger of injuring the flower.

A strip of fine muslin of the proper width (*A*) is folded lengthwise, stitched along the edges and cut into pieces long enough to fasten easily over the ends of a wire frame (*E*). This is formed by bending a strip of wire netting (*B*) around a test tube and turning back the ends of the long wires to hold the frame together. The frame is now cut off and inserted in the muslin tube by means of a somewhat larger test tube (*C*). A piece of fine copper wire at each end completes the whole (*D*).

(1) See also *B.* Jan. 1915, No. 27. (*Ed.*)

To use, one end of the cloth is turned back over the frame like a cuff (*F*). It is then slipped over the flower and the cloth fastened about the stem with a few twists of the wire as at (*G*). The frame may then be read-




**Device for protecting pollinated blossoms.**

ily opened to inspect or pollinate the flower by simply untwisting the upper wire and turning back the cloth.

25 – **Illustration of Inbreeding** (1). — JONES, D. F. (Plant Breeder, Connecticut Agricultural Experiment Station, New Haven, Conn.) in *The Journal of Heredity*, Vol. VI, No. 10 pp. 477-479, 2 figs. Washington, October 1915.

Albino seedlings in maize are common. Few fields are without a small number of them, but the percentage is so low as to be of no practical effect. When, however, inbreeding is practised abnormalities become quickly visible as has been successfully illustrated by the writer with a race of Leaming maize which had been self-pollinated for three generations. Albinism has been shown to be a simple recessive character, consequently in an inbred race one fourth of the plants must be albinos if they occur at all. In the writer's experiments two rows in the field representing two ears from the same inbred race gave 72 white and 232 normal green plants.

There were on hand nine ears representing nine different plants of

(1) See also *B.* April 1915, No. 371. (*Ed.*).

this inbred lot which were grown in 1914 from a hand-pollinated, selfed plant in 1913. Eight of these nine ears were hand pollinated and selfed. One ear was not selfed, but pollinated with a brother plant. About 30 seeds from each ear were planted in a plot. Of the eight ears two gave only green plants, six gave 34 albino plants and 108 green ones. The ninth ear produced only green plants. Theoretically two thirds of these ears should have been heterozygous for the abnormality and give albino plants in a three to one ratio. One third of the ears should give only green plants. Thus the results obtained coincided very closely with those expected.

26 – **Influence of Pollination on the Production of Red Clover Seed.** — See No. 41, below.

27 – **Experiments on the Pollination of Fruit Trees.** — See No. 61, below.

PLANT BREEDING

28 – **Plants Watered wth Salt Solutions and the Possibility of the Transmission of their Acquired Characters.** — LESAGE, PIERRE, *in Comptes Rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. 161, No. 15, pp. 440-442. Paris, October 11, 1915.

Plants watered with salt solutions show varying degrees of difference from individuals of the same species watered with ordinary water.

Experiments were carried out with seeds of *Lepidium sativum* watered with spring water, or with water with the addition of salt in proportion of 6.25 and 12.5 gms. per litre. The object was to determine whether the variations brought about by the use of salt are transmissible from one generation to the next, even when the cause which evoked them is suppressed.

The table in which are given the data of the experiments makes it evident that transmission of such characters does occur; small size, smaller proportion of large seeds, reduced weight of the seeds.

These characters, however, can be found in plants growing under unfavourable conditions of any kind; consequently in order to be able to settle the question definitely further experiments are necessary.

29 – **Inheritance of Habit in the Common Bean.** — NORTON, J. B. (Massachussetts Experiment Station) in *The American Naturalist*, Vol. XLIX, No. 585, pp. 547-561. Lancaster, Pa. September, 1915.

The observations here reported were made largely on third and fourth generation plants and the conclusions drawn are as follows :

I. Plant habit in beans is largely determined by the presence or absence of three characters which have been designated by the latters A, L, and T.

1) A represents the presence of axial inflorescence permitting an indefinite growth of the main stem and main branches, and a terminal inflorescence causing definite growth.

2) The factor L, representing length of axis is important in controlling plant habit and probably consists of a series of factors showing quantitative inheritance.

3) T is the factor for circumnutation upon which depends the climbing habit. The contorted stems of erect bush forms are probably caused by T.

II. The factors A, L and T may be present in any possible combination giving rise to the various habit types as follows :

| | | | |
|---|---|---|---|
| Type a. | *A L T* | . . . . . | Pole (or climbing) beans. |
| » b. | *A L t* | . . . . . | Runner beans. |
| » c. | *A l T* | . . . . . | Shoots |
| » d. | *A l t* | . . . . . | Semi-runners |
| » e. | *a L T* / *a L t* | . . . . . | Spreading with long out-stretched branches |
| » f. | *a l T* / *a l t* | . . . . . | Erect bush beans. |

III. When these types are crossed among themselves the results are approximately according to expectation. Thus, the third generation of a cross between a typical pole bean and a runner bean all showed axillary inflorescence; the climbing habit was developed in various degrees and classification was difficult. A cross between a pole bean and a bush bean gave a homozygous strain of pole plants and heterozygous types one of which gave runner and bush forms in the ratio of 9:7 and another in the ratio of 3 : 1.

A cross between a runner variety and a variety with spreading outstretched branches gave 20 bush plants and 58 of the runner and pole types.

A cross between runners beans (A L t) and bush beans (a l t) gave an $F_2$ generation consisting of 41 bush plants (e or f types) and 52 of the runner or semirunner types.

30 – **Apple Breeding in Idaho.** — VINCENT, C. C. (Agricultural Experiment Station, Moscow, Idaho) in *The Journal of Heredity* Vol. VI, No. 10, pp. 453-455. Washington, October 1915.

By the Adams Act approved March 6, 1906, funds were made available for agricultural research work in the State experiment stations. This fund made it possible for a number of stations to undertake plant breeding projects. One of the fruits to which especial attention has been devoted is the apple, and of recent years a number of stations, especially New York (Geneva), Iowa, Minnesota, South Dakota and Idaho have trees from hand crossed flowers of which both parents are known.

The object of the work at the Idaho Experiment Station has been the improvement of existing varieties by breeding.

The need of winter varieties of apples superior from every point of view to existing types has been keenly felt. There are many varieties already grown that have many desirable qualities but also some defects.

For the work of improvement the Ben Davis variety was taken as a basis, using it as male and female. The methods of securing cross pollinated fruits are much the same as those followed by plant breeders in general. The unopened blossoms are emasculated and pollen from other varieties applied. Usually two emasculated blossoms are left to the cluster. In the autumn the pollinated apples are harvested and kept in common storage until Christmas. They are then brought to the laboratory and the

seeds removed. They are given a serial number and tied in muslin bags. These bags are put in 2-inch pots, placed in flats and huried where they are exposed to freezing weather. As a precaution against destruction by mice, the flats have always been covered with screen wire. Late in February the flats are brought to the green house and the seed germinated. By subjecting the seed to the above conditions about 95 per cent germination has been obtained. By the midlle of May, the seedlings are from 10 to 12 inches in height ; they are then transplanted to the nursery in rows 3 feet apart, and 6 inches apart in the rows. The second season, the seedlings are transplanted to their permanent places in the orchard 6 feet apart each way. The results obtained thus far are as follows :

During the spring of 1910 a total of 1175 crosses was made, from which 146 seedlings were obtained. In 1911 3000 crosses were made and from them 1920 healthy seedling trees were secured.

In 1912 only 1703 crosses were made but the germination of the seed taken from these fruits was very successful and the results were that 3065 seedling trees grew. In 1913, 2823 crosses were made and they yielded 1470 seedlings. In 1914, 2527 crosses were made and from this number 4544 seedlings were grown.

Altogether there are at present 10 915 hybrid seedlings growing in the Moscow Idaho Experiment Station orchard and nursery, of which the following are the most numerous :

| Cross | | | Number of trees |
|---|---|---|---|
| *Female* | | *Male* | |
| Jonathan | × | Ben Davis | 2 575 |
| Ben Davis | × | Jonathan | 1 187 |
| Jonathan | × | Wagener | 1 066 |
| Wagener | × | Ben Davis | 835 |
| Wagener | × | Rome | 818 |
| Rome | × | Newton | 631 |
| Jonathan | × | Spitzenberg | 599 |
| Wagener | × | Jonathan | 485 |
| Rome | × | Spitzenberg | 337 |
| Rome | × | Wagener | 326 |

There are besides crosses of the varieties Arkansas Black, Gravenstein, Delicious and Winesap. This material will afford a good opportunity to study principles useful in plant breeding which will be conducted along the lines recommended by Luther Burbank, namely first of all those seedlings are selected which do not mildew, — this can be easily done while they are young and it eliminates one of the worst qualities in apple seedlings. Next, all the very slender growers with small deeply cut leaves are thinned out, because these always tend back to the wild state. In the next selection those having large fat round buds, large thick leaves and a stocky growth are preferred.

Such a procedure will enable the plant breeder to discard undesirable seedlings without having to grow each plant through to maturity in order to determine its character.

31 – **Official Register of Selected Plants in Hungary.** — KÖZTELEK. Year 25 No. 41, pp. 1478-1479. Budapest, October 9, 1915.

The Hungarian Minister of Agriculture has accepted the scheme proposed by Mr. Emile Grabner in his report presented in 1913 to the Royal Institute of Plant Breeding at Magyarovár (1) and has issued an order regarding an official register of selected plants in Hungary. On the basis of this regulation, the State recognition and official registration of selected Hungarian plants came into force, on September 1, 1915. The Royal Institute of Plant Breeding is responsible for the keeping of the official register. The effect of this provision will be to give an additional impetus to plant breeding which of latter years has already made such rapid strides in Hungary. On the one hand it will protect Hungarian growers from the adulteration of seeds and the false description of inferior seeds, and on the other hand, it will afford a safe guarantee to the purchasers of the strict selection of the species the seed of which they wish to acquire.

At the same time, the Minister of Agriculture has authorised the said Institute to present, as soon as possible, detailed schemes regarding the development, on a large scale, of the intensive selection of Hungarian plants. The Minister considers it desirable that the work of selection should not be left merely to a few enthusiasts but should be taken up in a methodical manner by all practical agriculturists, with the close collaboration of the said Institute.

The task of the Institute will be facilitated by the fact that the Committee of the National Society of Hungarian Agriculturists has been occupied with this question for a number of years, to say nothing of the reports of individual breeders. Hungarian agriculturists are convinced that the subject in question is of great importance and, indeed, the results already obtained (2) show clearly that improved strains are capable of yielding a crop far larger than any obtained hitherto and of increasing the present revenue of the country by 25 to 30 per cent.

The essential features of the Order regarding the official registration of selected plants in Hungary have been elaborated upon the lines of the scheme presented by the Director of the above-mentioned Institute.

32 – **The Effect of Sorting Grain on the Yield of Wheat.** — MALPEAUX L. in *La Vie Agricole et Rurale*, Year 5, No. 22, pp. 395-398. Paris, November 27, 1915.



The best method of sorting seed is one which takes into account not only length and thickness, but also density, or weight.

In the case of wheat, this is effected by means of special apparatus, such, for instance, as the turbine sorter, recently invented by Marot. This sorter has given very interesting results with different varieties of wheat; these data are summarised in the following table.

(1) See *B.* June 1913, No. 624. (*Ed.*).

(2) See *B.* 1912 Nos. 325-326 - 651; *B.* 1913, Nos. 353 - 1133; *B.* 1914, Nos. 25 - 223 - 224 225 - 323 - 421, *B.* 1915, No. 699. (*Ed.*).

TABLE I. — *Results Given by* MAROT *Sorter.*

| Seed | Weight of bushel in lbs. | | | |
|---|---|---|---|---|
| | Massy wheat | Bon Fermier | Roseau wheat | Dattel wheat |
| Ordinary . . . . . | 64.3 | 65.8 | 63.4 | 64.7 |
| Coarsely sorted. . . . . | 65.8 | 66.1 | 64.2 | 66.1 |
| Finely sorted . . . . . | 63.0 | 63.8 | 62.2 | — |
| Sorted and treated in turbine. | 66.6 | 66.4 | 64.6 | 66.6 |
| Sorted and submitted to blower. . . . . | 65.4 | 65.49 | 63.2 | 65 |

Seed sorted by different methods was sown in separate plots at the same date and under identical conditions of soil and manuring; the results obtained on threshing are given in Table II.

TABLE II. — *Results obtained on threshing* (lbs).

| Varieties | Grain sorted by ordinary method | | Grain sorted and treated in turbine | | | |
|---|---|---|---|---|---|---|
| | | | Heavy | | Light | |
| | Straw | Grain | Straw | Grain | Straw | Grain |
| Dattel . . . . . | 165 | 77 | 169 | 79 | 169 | 67.1 |
| Roseau. . . . . | 161 | 67.1 | 156 | 69.3 | 155.1 | 64.9 |
| Massy . . . . . | 132 | 69.3 | 132 | 73 | 136 | 70 |
| Bon Fermier . . . | 152.9 | 70 | 155 | 81 | 150 | 64 |
| Treverson . . . . . | 152 | 84 | 152.9 | 86 | 147 | 81 |
| Blanc de Flandres . | 158 | 70 | 165 | 73 | 156 | 71.5 |

The differences bring out very clearly the superiority of large heavy grain.

Sorting on the basis of density results in an increase in the weight of the grain, as is shown in Table III. — These figures were obtained by weighing 100 seeds harvested from each plot.

The weight is given in grammes.

TABLE III.

| Varieties | Grain sorted by ordinary method | Grain sorted and subsequently selected by turbine | |
|---|---|---|---|
| | | Heavy | Light |
| Dattel | 4.796 | 4.990 | 4.736 |
| Roseau | 7.026 | 5.180 | 4.936 |
| Massy | 6.000 | 7.230 | 6.880 |
| Bon Fermier | 5.402 | 6.310 | 6.294 |
| Treverson | 4.710 | 4.834 | 4.600 |
| Blanc des Flandres | 4.680 | 4.820 | 4.544 |

33 - **The Maize Producing Industry in Victoria.** — SMITH, T. A. (Chief Field Officer) in *The Journal of the Department of Agriculture of Victoria*, Vol. XIII, Part 3, pp. 129-137. Melbourne, March 1915.

Much of the land in Victoria is particularly suited to maize growing especially the rich flats on either side of the numerous rivers north and south of the Main Dividing Range. The rainfall is sufficient and the summer season long enough and hot enough to ripen the crop. Nevertheless the area actually under this crop is comparatively small, the total acreage being 18 223 in 1912.

The average yield in this State for the last decade is 55 bushels per acre compared with 26.8 for the Commonwealth. The total value of the maize crop in Victoria was £ 168 440 in 1912 equivalent to £ 9-4-10*d.* per acre. In 1910 the average yields per acre in Australia were only exceeded by those of Canada 57 bushels p. acre and Egypt 34.2 bushels per acre.

There are however authentic cases of yields reaching 140 bushels per acre.

Except in years of exceptional drought the overseas trade in maize is insignificant. The principal countries to which maize has been exported from the Commonwealth are South Africa, New Zealand, and China, while the principal countries from which importations have taken place are the Argentine Republic, New Zealand, the United States, Pacific Islands, South Africa and Java.

34 - **"Ranghino Rice".** — NOVELLI, N. in *L'Italia Agricola*, Year 52, No. 11, p. 496, 1 plate. Piacenza, November 15, 1915.

This variety has been of considerable importance in the progress of rice cultivation in Italy. It was selected about 20 years ago by the brothers Ranghino of Vercelli from some imported Japanese rice. The relative variability of its characters suggests a hybrid origin as the result of natural cross-fertilisation. Its cultivation has now extended throughout the greater part of the rice growing tracts in Italy, especially Vercelli, Novara, Bologna, Lomellina and Mantua. It is also cultivated in Brazil and Spain.

It is suited to various fairly rich types of soil and grows well also in

somewhat cold soils, being generally sown in two and three year old plantations. It is of vigorous growth, tillers well giving a good yield, is early in maturity and disease resistant.

It is much appreciated on the market and mills well. Recently it has shown some signs of degeneration in some of its best characters such as productivity and disease resistance.

35 - **Tetraphosphates in Rice Lands.** — NOVELLI, N. in *Il Giornale di Risicoltura*, Year V, No. 21, pp. 337-340. Vercelli, November 15, 1915.

The results of experiments carried out at Vercelli for the Ministry of Agriculture, Industry and Commerce in Italy.

The experimental ground was previously occupied by *Trifolium repens* under irrigation. Corresponding quantities of tetraphosphate and mineral phosphate were compared on two plots receiving similar treatment with regard to the nitrogen and potash manuring. Weekly observations carried out on the two plots showed no sensible difference. The writer mentions similar results using a basic phosphate in comparision with a pyrophosphate.

In these rice-growing districts steamed bones are frequently used with good results, thus showing that untreated phosphates may be used in place of superphosphates.

In the soils of the principal rice-growing districts subject to frequent submersion and periodic irrigation special conditions exist, in which basic phosphates may possess a manurial action not inferior to that of superphosphates. The writer also maintain that the very high content in organic acids of such soils may effectively and rapidly bring about the necessary change to make the phosphates more available, similar to that effected by sulphuric acid in the case of superphosphates. The soils of these regions have shown a considerable increase of organic matter of a slow rate of decomposition and a very small lime content (They contain from 40 to 100 parts per 1000 of organic matter and an acidity equivalent to from 5 to 10 or 12 c.c. per 1000 of normal potash). Such a high content in organic acids assisted by the sandy nature of the soils containing 800 to 900 parts per thousand of sand is particularly favourable to the reduction of the tricalcic phosphate to the bicalcic salts.

The writer also believes that in old rice fields containing much acid, superphosphate often does not give good results since the acidity of the soil is thereby still further increased.

36 - **The Differences of Humidity in Ripe Paddy** (1). — MARAGHINI, VITTORIO, in *Il Giornale di Risicoltura*, Year V, No. 21, pp. 340-345. Vercelli, November 15, 1915.

One of the requirements most desired in a paddy drier is the production of uniform product. To ensure this result it is necessary to realise that different lots of grain contain different degrees of humidity and since the drier only removes a portion of the moisture differences will exist in the final product. It is already known on *a priori* grounds that the moisture content of paddy grains varies in the same field in the same season since the

(1) See also *B.* November 1915, No. 1210. (*Ed.*).

grains become drier with maturity and maturation varies at different places in the same field and even in different positions on the same ear.

These differences were determined by the writer in rice crop considered for all practical purpose as homogenoeus. The field selected was at Rozzano near Milan and had an area of 22 acres. The season 1915 was normal and the harvest very clean. Determinations of the humidity at 110° C. gave results as follows :

| | Percentage humidity by weight relative to green paddy. |
|---|---|
| *Samples from the centre of the field* : | |
| Grains of the entire ears | 21.9 |
| » » » tips of the ear | 20.6 |
| » » » base of the ear | 22.6 |
| *Samples from a place near the irrigation channel* : | |
| Grain of the entire ear | 30.9 |
| » » » tips of the ear | 27.4 |
| » » » base of the ear | 33.5 |
| Maximum difference of humidity between the different lots of paddy in the field, expressed as percentages of average humidity | 47.7 |
| Maxmimum difference of humidity between grains of the same ear, expressed as percentage of average humidity : | |
| for ears from the centre of the field | 9.3 |
| for ears from near the irrigation inlet | 20.3 |

The humidity is therefore less in the case of ears collected from the centre of the field than for those collected near the irrigation inlet. It is also less for grains at the summit of the ear than for those at the base, this difference being about 10 per cent of the average humidity. Obviously the differences of humidity of the crop submitted to drying are far from negligible, and are certainly greater for a harvest less favoured by season and situation than the one used in these investigations.

37 – **"Iburu" and "Fundi", Two Cereals of Upper Guinea.** — STAPF, O., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 8, pp. 381-386, 2 figs. London, 1915.

A cereal called "Iburu" was mentioned in 1911 and again in 1912 as being grown in Northern Nigeria but no description was given of it. Recently, however, specimens of Iburu were received from Northern Nigeria (Zairia, Hausa State). The writer describes it under the name of *Digitaria Iburua* Stapf. It has botanical affinity with *D. ternata* Stapf. The inflorescence is a subcomposite raceme which may contain as many as 200 spikelets, yielding between 1000 and 2000 grains. The application of pressure suffices to separate these fairly readily from the surrounding husks. The grains in the sample received are pure white in colour. They weigh in their husks on the average 0.7 mgms.

Fundi has for some time been known as a cultivated cereal in West Africa. It was first observed at Sierra Leone in 1798 and again in 1842. In 1900, Dr. A. CHEVALIER noticed it and identified it with *Paspalum longi-*

*florum* and gave "Fonio" as the native (Bambara) name. According to him it is cultivated almost all over the French Sudan in Upper Gambia, Upper Casamance and Fouta-Djallon. Later it was mentioned as cultivated over French Guinea, in Togoland and in Northern Nigeria. The writer describes it under the name of *Digitaria exilis* Stapf. It closely resembles *D. longiflora* Pers. which is probably the wild ancestral form.

This grain has a very good flavour and it is believed that if it were exported to Europe it might prove a valuable addition to the light farinaceous articles of food used by the delicate or convalescent. The plant is said not to require manuring and to thrive well in light soils and even in rocky situations. It is grown in Nigeria on the Bauchi Plateau at an altitude of 4000 ft.

STARCH CROPS

38 – **Experiments in Germany on the Effect of the Selection of Seed Potatoes upon the Yield** (1). — SCHNEIDEWIND, in *Deutsche Landwirtschaftliche Presse*, Year 42, No. 88, pp. 751-752. Berlin, November, 3, 1915.

The tubers used for the experiments were large (from 120 to 140 gr.) average (80 to 100 gr.), and small (60 to 70 gr.) and were planted in 2 different plots. The large and average sized tubers were either planted whole or in pieces while the small ones were always planted whole. The seed pieces were obtained by dividing the tuber in two along its short axis, and only the terminal portion bearing eyes was used. The varieties employed were "Imperator", Industrie" and "Wohltmann No. 34 of Lochow". The area of each plot was 39.34 sq. yds in the first series of experiments and 37.39 sq. yds. in the second.

The experiments showed that the size of the tubers has not much effect on the crop. The maximum yield was obtained with average sized tubers and the minimum with small tubers, but the difference was very slight. The large tubers produced on an average 429.7 cwt. of tubers containing 73.6 cwt. of starch ; the medium-sized seed-potatoes gave 438.7 cwt. of tubers containing 76.2 cwt. of starch; while the small ones produced 409.9 cwt. and 71 cwt. respectively. The best crop was thus obtained from tubers weighing from 80 to 100 gr.

In the case of the seed pieces, the yield was different. Certain kinds, such as "Imperator", should not be divided, but others "(Industrie", Wohltmann No. 34 of Lochow) are less susceptible to this operation, as a rule, the fragments, yielded a smaller crop than the whole tubers and the writer advises that the former should never be used for planting.

39 – **The Cultivation of Yams in Brazil.** — TORREND, P. C. in *Broteria, Vulgarizaçao Scientifica*, Vol. XIII, Part VI, pp. 287-293, 3 figs. Braga, November 1915.

Señor P. FERNANDEZ BARRETTO a farmer of Jequiriça (state of Bahia) supplied the writer with the information given below. He grows "inhame da costa" (*Dioscorea alata*) since 1870 obtaining, in favourable years, tubers attaining weights of 32 and 37 lbs. Besides the giant variety he grows also a small one. An illustration which accompanies the paper shows a giant tuber 24 inches in length and a group of small ones each about 4 inches long.

(1) See also *B.* August 1915, No. 803 ; *B.* October 1915, No. 1032. (*Ed.*).

This dwarf variety may be grown also in compact and dry soils, whilst the large variety requires fresh loose soils rich in humus. As the tubers of the former are produced in groups of 15 to 20 per plant, their yield per acre is not much inferior to that of the giant variety.

Señor BARRETTO describes the methods of cultivation followed by him and then gives some information on the cultivation of the common yam (*Dioscorea batatas*) and on its value as human food, for industrial purposes and for the fattening of live stock, especially pigs.

40 – **Cultivation of the Lotus (*Nelumbium speciosum*) and the Microscopic Examination of its Flour.** — PELLEGREFFI MARIA in *Archivio di Farmacognosia e Scienze affini*, Year IV, No. 1, pp. 1-4. Rome, January 15, 1915.

The flour obtained from the root of the Lotus is in great favour with Orientals. The plant is a perennial aquatic with a large white fleshy cylindrical rhizome having a polished shining surface.

The plant is easy of cultivation and grows rapidly without requiring special conditions of climate or surroundings. It grows also fairly well in some parts of Italy. The writer considers the cultivation of this plant to be worthy of trials in marshy regions in Italy.

The flour is made by the Chinese who value it both as a food and as a medicine.

It is pinkish white in colour, greasy to the touch, and crackles when pressed between the fingers. It is similar to arrowroot in appearance and under the microscope resembles potato flour. It cannot be confused with the latter since the granules are somewhat smaller, more regular in shape and the hilum is longer and not excentric.

To extract the flour, the rhizomes are first dried, then macerated in cold water for 3 days and nights. It is then reduced to a paste by pounding in a mortar and again treated in cold water. After decantation the paste is exposed to the sun and dried, after which it becomes first quality Lotus flour.

41 – **Red Clover Seed Production, Pollination Studies.** — WESTGATE, J. M. and COE, H. S. in collaboration with WIANCKO, A. T. and ROBBINS F. E. of the Indiana Agricultural Experiment Station, HUGUES, H. D., PAMMEL, L. H. and MARTIN, J. N. of the Iowa Agricultural Experiment Station. *United States Department of Agriculture, Bulletin* No. 289, pp. 31, figs. 7. Washington, September 21, 1915. FORAGE CROPS, MEADOWS AND PASTURES

A study of the cytology of red-clover flowers shows that many of them contain infertile ovules. The percentage of these is greater in the first crop than in the second. In the first crop many plants produce 100 per cent of infertile ovules, while in the second crop the percentage of infertility ranges from none to a high figure. The percentage of infertile ovules in red clover is probably correlated with moisture conditions.

The pollen grains of red clover are very sensitive to moisture. On account of this, there can be little effective pollination when the flowers are wet. Germination of the pollen grains takes place only within a limited range of variation in the water supply. It is probably true that the only function of the stigma is that of supplying the requisite amount of water to the pollen for germination.

The time between pollination and fertilization varies with the temperature of the atmosphere. The time between pollination and fertilization in July is approximately 18 hours, while in October it varies from 35 to 50 hours. An examination of 30 flowers which had been self-pollinated for 55 hours showed good germination on the stigmas but no fertilization. The pollen tubes made a slow growth and none exceeded 4 mm. in length. In flowers which had been self-poliinated for 90 hours one pollen tube attained a length of 7.5 mm. while the rest were 5 mm. or less in length. The pistils of red clover average about 12 mm. in length. Ovules were found to be disintegrating four days after the flowers opened.

The self-pollination and cross-pollination experiments which were conducted in the field checked up very closely with the results obtained from the cytological studies. The average yield of seed obtained on heads which were not pollinated and on heads which were self-pollinated in different ways was less than one-half of 1 per cent. This small yield of seed may be accounted for by the occasional access of bees to these heads for a very short time, on account of rains or grasshoppers mutilating the tarlatan which was used to cover the heads.

The bunble-bee is an efficient cross-pollinator of red clover. Bumble-bees are able to pollinate from 30 to 35 flowers per minute.

The honeybee proved to be as efficient a cross-pollinator of red clover as the bumble-bee in 1911. When the precipitation was considerably below normal in June, July and August, 1911, and but few nectar-producing plants were to be found, honeybees collected large quantities of pollen from red clover. In order to collect pollen they must spring the keels of the flowers. In doing this they cross-pollinate the flowers.

A clover cross-pollinizing machine which was offered for sale on the market and which consisted of a platform of brushes so constructed that it could be made to strike the clover heads with a vertical stroke did not prove to be an efficient cross-pollinator of red clover.

The various types of hand-operated brushes which were used did not prove efficient as cross-pollinators of red clover. In nearly all cases where these brushes were used the seed yield was decreased instead of increased. This was undoubtedly due to the bristles of the brushes injuring the flowers, since the average seed yield of the plots which received three treatments with the brushes was lower than that of the plots which received but one treatment.

In appendix a list of 46 works on the subject is given.

42 – **Value of Sudan Grass** (1) (***Andropogon sorghum***) **as a Forage Crop.** — STEMMONS, WALTER in *The Country Gentleman*. Vol. LXXX, No. 46, p. 1712. Philadelphia, November 13, 1915.

Sudan grass (formerly erroneously called *Andropogon halepensis*) is probably the most drought resistant hay-plant known. It will grow on land that will not produce alfalfa and accomodates itself to almost any type of soil.

(1) See also *B.* July 1913, No. 799. (*Ed.*)

At the Oklahoma Agricultural Experiment Station Sudan grass yielded an average of about 4 tons of hay to the acre at the first cutting. At least 2 tons to the acre may be added to this for the yield of the second crop. An average hay yield would be 3 to 5 tons to the acre.

Analyses of Sudan grass show it to have a higher feeding value than timothy hay. It will not equal alfalfa in protein content but may be successfully fed with alfalfa or alone. All stock relish the hay, and horses, mules and pigs will eat it more readily than they do alfalfa.

In the winter of 1914-15 the Kansas Experiment Station conducted feeding trials with yearling heifers including Sudan grass in the ration. The results of these experiments showed that gains were made at lower cost with this roughage than with any other; further, this hay was found of higher feeding value than a medium grade of alfalfa. However, dairy tests at the same Station proved that a good grade of alfalfa was more mutritious than Sudan grass.

As regards methods of cultivation, in humid localities Sudan grass will probably yield more hay when broadcast, but under conditions of less rainfall better results are obtained by planting in rows from 18 to 42 inches apart. In the Great Plains region rows 36 to 42 ins. apart have given the best results.

Seeding at the rate of 4 to 8 lbs per acre has given the best results but the plant stools extensively and good results have been obtained from 1 to 3 lbs per acre.

The grain sorghums require from 80 to 140 days to mature. Sudan grass matures its first crop in 60 to 80 days in the Southwest of the United States. With such a short growing period the crop planted in spring could be harvested before drought.

43 - **Brazilian Cottons.** — COELHO DE SOUZA W. W., in *La Hacienda*, Vol. XI, No. 1, pp. 28-29, 6 figs. Buffalo, N. Y., October, 1915. FIBRE CROPS

The writer describes the species of cotton in North-west Brazil as follows :

*Gossypium arboreum*, with black seeds.

*G. religiosum* (" quebradinho ") with black seeds grouped in pyramids of 7 to 9.

*G. barbadense* (" algodon de Gerico " ; " Moco " ; " Ico " ; " Caicó " ; " Gerido ") resembling Egyptian cotton.

*G. hirsutum* green villous seeds; occurs in North-West Brazil and is known as " riqueza " or " azulao ".

*G. herbaceum* white or brown seeds, villous. Includes all the cottons of the southern part of Brazil, especially the State of São Paulo.

In the north-west part of Brazil is a variety known as " algodoi " characterised by the reddish-brown colour of its silks and its great height ; the writer has not been able to identify it.

CROPS YIELDING OILS, DYES AND TANNINS

44 - **Experiments on the Physiology of Indigo-yielding Glucosides.** — PARNELI, F. R (Government Economic Botanist, Madras) in *Memoirs of the Department of Agriculture i India, Botanical Series*, Vol. VII, No. 5, pp. 195-212. Calcutta, October 1915.

An indigo-yielding glucoside is present in the root and seed of both *Wrightia tinctoria* Br. and *W. tomentosa* R. and S. but is absent from the leaves of the latter.

The glucoside and its enzyme in *W. tinctoria* are distinct from those of *Indigofera arrecta* and *I. sumatrana* although Wrightia enzyme has some action on *Indigofera* glucoside and vice versa. The seed of *W. tinctoria* when germinated and grown without nitrogen increases in glucoside content till it becomes about trebled at about 40 days. As nitrogen starvation begins to show the amount decreases but is still considerable when the seedlings are on the point of death. The seedlings of *W. tomentosa* show no appreciable increase of glucoside under the same conditions.

When cuttings of *Polygonum tinctorium* and *Strobilanthes flaccidifolius* are grown without nitrogen part of the glucoside disappears, presumably being used up as a nitrogenous reserve. In *W. tinctoria* and *I. arrecta* the maximum percentage content occurs at a very early stage in the development of the leaf. The actual amount in any leaf, however, increases during growth to a maximum at maturity and remains constant till leaf-fall when the whole is present in the fallen leaf. Indican is also produced in the dark by etiolated shoots of *I. arrecta* and there is no variation in indican content between night and day in *I. arrecta* and *I. sumatrana*. Moreover no marked effect is produced by keeping plants of *I. sumatrana* in the dark for 36 hours.

The writer concludes that in the light of present knowledge no definite function can be assigned to indigo-yielding glucosides in general or to the glucoside of any secial species.

RUBBER, GUM AND RESIN PLANTS

45 - **Rubber-Producing Plants in Southern Italian Somaliland.** — SCASSELLATI SFORZOLINI, G. in *L'Agricoltura Coloniale*, Year IX, No. 9, pp. 521-545. Florence, September 30, 1915.

The writer has compiled information relating to the indigenous rubber plants of Somaliland that have been examined by technical experts.

WILD SPECIES. — These are divided into three groups.

*A*) OF INDUSTRIAL IMPORTANCE:

1. *Euphorbia Tirucalli*, L. (1), a xerophilous plant widely distributed throughout Italian Somaliland, often attaining large proportions. The coagulum contain 12.2 per cent of caoutchouc of moderate elasticity and 87 per cent of resin. Industrially it may be used as a substitute for "Jelutong.". This plant is already worked commercially in Natal, Rhodesia, etc.

2. *Euphorbia cuneata* Vahl., a woody bushy shrub occurring in greatest numbers among the woods of the coastal dunes. It yields a dense white latex containing 17.7 per cent of caoutchouc of poor elasticity and 81.8 per cent of resin. The product may have some industrial value and the tree in addition to producing rubber may also be used for forming hedges.

(1) See *B.* Jan. 1911, No. 189; March 1913, No. 203. (*Ed.*).

3. *Landolphia florida* Benth, a woody climbing plant of similar habits to the grape vine, widely distributed throughout Africa, abundant in the forests of Somaliland near river banks. The latex coagulates slowly on boiling and also spontaneously on exposure to air. The coagulum contains 18.8 per cent of clear coloured, elastic caoutchouc suitable for industrial purposes (1).

4. *Landolphia petersiana* Dyer., a liane similar to the preceding; grows in great quantities in forests along the river Juba; yields an extraordinary quantity of rubber latex. In British East Africa it is considered to be of great industrial value, since the coagulum contains 88.3 per cent of caoutchouc and only 3 to 7 per cent of resin. At the Imperial Institute, London, this rubber was considered to be of the best quality. This plant is also suitable for planting in the regions of Somaliland where it does not already occur. The technological value of this rubber was judged by the experts of Messrs Pirelli and Co. of Milan.

*B*) NOT OF INDUSTRIAL IMPORTANCE:

1. *Ficus scasscellatii*, Pamp.; 2. *Euphorbia grosseri* Pasc.; 3. *Adenium coëtaneum* Stapf.

*C*) NOT YET ANALYSED:

1. *Euphorbia bilocularis* N. E. Br. a tall tree with the typical candelabra-like habit of growth, widespread on the dunes and alluvial plains; yields an abundant latex with viscous properties.

2. *Excœcaria venenifera* Pasc., a large woody plant, height about 25 feet, of frequent and wide occurrence in the forests of the Juba valley. Yields quantities of a latex which irritates the skin.

3. *Hunteria africana*. K. Schum., a shrub collected in the forests of the Upper Goscia, yields a latex apparently containing rubber.

4. *Euphorbia hypericifolia* Linn., an herbaceous plant yielding a latex which apparently contains rubber.

5. *Pergulia extensa* (Jacq.), N. E. Br. = *Daemia extensa* R. Br., trailing plant yielding an apparently rubber bearing latex.

CULTIVATED PLANTS. — This part of the brochure concerns experiments on the cultivation of *Manihot Glaziovii* in the lower Uebi Scebeli and the upper, middle and lower Goscia.

The results are not yet conclusive but for the middle Goscia region and the valley of Uebi Scebeli they confirm the results obtained in the neighbouring German and English Colonies that this species is adapted to these latter regions. A sample of rubber from the "Azienda Sperimentale di Gemale" however was notable in that its analysis showed a superior commercial value to other samples of Ceara rubber from East Africa with respect to the percentages of caoutchouc, resin, protein and ash.

46 – **The Smoking of Plantation Rubber.** — EATON, B. J. in *The Agricultural Bulletin of the Federated Malay States*, Vol. III, No. 11, pp. 425-428. Kuala Lumpur, August 1915.

The formation of rusty or resinous crusts on the surface of sheet rubber is due to the exudation of serum which dries on the surface during the

(1) See *B.* Jan. 1911, No. 188; Feb. 1911, No. 507; Aug.-Sept.-Oct. 1911, No. 2735; Nov. 1912, No. 1529; Jan. 1913, No. 13, and Feb. 1913, No. 132. (*Ed.*).

smoking process. Analysis shows this deposit to consist of more than 60 per cent of protein, the remainder being resin (acetone extract) and mineral salts.

As a remedy it is suggested that the sheets be soaked in large pans of water after machining and allowing them to drain thoroughly before drying.

As an effective control of the temperature of the smoke-sheds the writer recommends the thermograph as giving a more complete record of the rate of drying during the night than the ordinary maximum and minimum thermometer.

The sweating of rubber in smoke houses is attributed to the condensation of water vapour from the fuel. It occurs most frequently when the furnace is exterior to the smoke room. The remedy suggested is a slower fire placed within the smoke house itself so that the more easily condensed products reach the rubber and the water vapour is driven out.

47 – **Variation in Plantation Rubber.** — EATON, B. J. and GRANTHAM J. in *Agricultural Bulletin of the Federated Malay States*, Vol. III, No. 10, pp. 397-401. Kuala Lumpur, July, 1915.

The effect of each stage in the preparation of thin crepe in lengthening the optimum time of cure was investigated as follows :

Samples of rubber were prepared as follows :

A. Coagulated slab allowed to drain.
B. The coagulum rolled once.
C. Rough Crepe.
D. Thick Crepe.
E. Thin Crepe.

The samples were kept for 20 days when A, B and C were made into thin crepe and dried preparatory to mixing. D and E were dried without subsequent crepeing. Each sample was vulcanised for 8 or 9 different times. The results showed that the rate of cure decreased continuously from A to E, the times of optimum cure being as follows:

| | | | |
|---|---|---|---|
| A. | 1 ½ hours | D. | 2 ¾ hours |
| B. | 2 » | E. | 3 » |
| C. | 2 ½ » | | |

This effect of crepeing immediately after coagulation should be distinguished from that produced by additional crepeing beyond what is necessary to produce thin crepe (1).

A series of estate samples were obtained and tested to ascertain how far uniformity is possible under ordinary estate conditions. The samples were taken from the crepe prepared from latex bulked immediately after coagulation over a period of 10 days. No special precautions were taken in their preparation. Seven of the samples showed optimum cure in 3 hours and the remaining three in 3 ¼ hours. The seven samples showing the same rate of cure have identical poperties below the breaking point and showed a

(1) See *B.* Oct. 1915, No. 1041. (*Ed.*).

maximum variation of only 8 per cent at the breaking point. It is therefore possible to produce a uniform rubber under ordinary estate conditions provided the condition of tapping and preparation are kept uniform.

The disadvantages of this method of preparation are: 1) the long time of cure required and 2) a slight decrease in the maximum mechanical properties.

48 - **Some Little-known Resins.** — *Bulletin of the Imperial Institute*, Vol. XIII, No. 3, pp. 356-375. London, July-September 1915.

A large number of resinous products have recently been examined at the Imperial Institute. They are of two types: resinous latices and elemis or oleo-resins.

Resinous latices are of variable composition containing from 2 to 20 per cent of caoutchouc. Some have acquired commercial importance for mixing with rubber but in the majority of cases no satisfactory method of using them as resins has yet been put forward.

The composition and properties of the latices of the following plants has been determined:

*Dyera costulata* known as "jelutong" "pontianak" "bresk" or "dead Borneo".

*Euphorbia* from Natal; *Euphorbia Tirucalli* from Natal and Mauritius.

"Tshizimboti" (*Euphorbia* n. sp.) from Rhodesia.

*Euphorbia canariensis* from the Canary Islands.

*Conopharyngia elegans* from the Transvaal.

*Diphlorrhynchus mossambicensis* or Gutta from Beira.

*Anthostema senegalensis* Guss or "Tufui" from Sierra Leone.

Indigenous fig tree from Southern Rhodesia (*Ficus utilissima?*) *Mimusops cuneifolia* from Uganda.

Elemi resins.

The original elemi resin is obtained from *Canarium luzonicum* in the Philippines. Other oleo-resins are obtained from *Canarium colophania* from Mauritius and *Dacroydes hexandra* in the West Indies, known as "Dry elemi" or gommier resin.

49 - **Camphor and Camphor Oil from Malaya.** — Eaton, B. J. in *Agricultural Bulletin of the Federated Malay States*, Vol. III, No. 10, pp. 402-404. Kuala Lumpur, July 1915.

Specimens of camphor oil and camphor obtained from the Japanese Camphor tree (*Cinnamomum camphora*) were submitted to the Imperial Institute for valuation.

Two samples of oil gave the following results on analysis:

| | I. | II. |
|---|---|---|
| Specific gravity at 15° C | 0.913 | 0.920 |
| Optical Rotation in 100 mm. tube | 41°.1′ at 18° C | 38°.23′ at 22° C. |
| Camphor content on cooling to — 10° C to — 12° C. | 19.3 per cent | 12.8 per cent. |
| Acid value | — | 1.1 |
| Saponification (original oil) | — | 3.6 (= 0.07 per cent esters) |
| Saponification after acetylation | — | 25.7 (= 6.1 per cent alcohol) |

In both cases the oil was pale yellow in colour and contained a considerable quantity of crystalline deposit. Prolonged cooling of sample II yielded a total of 14.2 per cent of camphor.

Both samples were free from safrole to which constituent the Japanese product owes its commercial value. This is probably accounted for by the fact that the Malayan oil was distilled from young twigs and leaves.

The oil was valued at prices ranging from 4 3/4 *d.* to 7½ *d* per lb. in London.

A sample of crude crystalline camphor was analysed with the following results:

| | |
|---|---|
| Moisture and oil removed by pressure | 11 to 12 per cent |
| *Optical Rotations*: | |
| Crude camphor | + 40° 50' |
| Crude camphor after pressing | + 42° 20' |
| Camphor recrystallised from benzine | + 41° 25' |
| Camphor separated from oil | + 42° 20' |

Refined camphor generally varies between 41° and 40°. Commercial experts valued the solid camphor at £6 to £6-5*s* per cwt. with the better quality Japanese Monopoly B. Camphor at £7-2-6*d* per cwt.

SUGAR CROPS

50 – **Experiments in Covering Cane by Plough and by Spade.** — ROSENFELD, A. H. (Director, Agricultural Experiment Station, Tucuman) in *The International Sugar Journal*, Vol. XVII, No. 200, pp. 345-392. London, August, 1915.

In the province of Tucumán, Argentina, it is the custom to cover planted cane by means of the spade, whilst in Louisiana the cane is generally covered by means of a small share plough. Considering the difference in labour and cost between the two practices experiments were undertaken to investigate this question. For this purpose a plot of native purple cane was chosen, consisting of 8 rows 25 metres in length and 1 ½ metres apart. Every second row was covered by means of a small plough while the others were covered by spade.

The average results of two harvests are given in the following table:

| Treatment | Kilograms of cane | | Stalks | |
|---|---|---|---|---|
| | per row of 100 metres | per hectare | per row of 100 metres | average weight |
| Covered by plough | 592.5 | 39 105 | 872.5 | 0.67 |
| » » spade | 534.2 | 35 254 | 823.0 | 0.65 |

Almost without exception the rows covered by the plough actually produced more cane than those covered by the spade during two successive seasons. It is suggested that the superiority of the ploughing is due to the coarser therefore more open condition of the soil.

51 - **The Effect of Removal of the Leaves upon the Sugar Content of Individual Beets.** — — MUNERATI, O.; MEZZADROLI, G.; ZAPPAROLI, T. V. (Royal Experiment Station for Beet-growing, Rovigo), in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLVIII, Part 10-11, pp. 743-771, figs. Modena, 1915.

From the results of their first series of experiments (1) the writers have already concluded that " as was to be expected, repeated removal of the leaves has caused a distinct loss of sugar in the roots ". These have been amplified by the use of two other methods of investigation : 1) determination of the sugar content of each beet at two dates without lifting the plant ; 2) lifting the beets for weighing and determination of the sugar content, replanting them immediately afterwards, and lifting them again later for the second determination..

The first method affords a means of ascertaining the percentage loss of sugar in the stripped beets, but does not allow of accurately determining whether there has been an actual loss in the sugar reserve, as the necessary weight factor is wanting.

For each method there were control plots of unstripped beets beside the experimental plots of stripped ones.

From the numerous analytical data obtained the following conclusions are drawn :

1) Observations made on the individual beets of each group give a clearer explanation of a phenomenon than the results of the analysis of a given group as a whole.

2) The beets not lifted for the first analysis and then subjected to repeated stripping showed a continuous and progressive decrease in the percentage of saccharose, the difference amounting in some cases to over 5 per cent, while the beets of the corresponding unstripped groups growing under the same conditions showed a steady increase in saccharose content eventually exceeding 5 per cent. Thus the range between the maximum decrease in the stripped beets and the maximum increase in the unstripped ones exceeded 10 per cent.

3) The beets lifted for the first analysis and then replanted showed, as was to be expected, markedly different behaviour according as they were subjected to continual stripping or left unstripped.

*Weight.* — In the case of beets not stripped again after replanting, the increase in weight was constant, but strictly proportional to the growth made by the new leaves : those with plenty of top more than tripled their weight in about three months, while the weight of those with scanty, weak leaves showed little change. In beets continually stripped (at intervals of not more than a week from July to November) the weight remained constant or diminished.

*Total sugar.* — In the unstripped plants this followed the same ascending scale as the weight of the root, or in other words, was proportional to the leaf development in each beet ; in the stripped beets the sugar reserve in the roots became steadily and progressively depleted.

*Percentage of sugar.* — This decreased steadily and progressively in the stripped beets. In those not deprived of their leaves, after a first decrease due to the growth of the first new leaves, the sugar percentage remained almost stationary, as the weight of the root increased

(1) See *B.* May 1915, No. 507 ; *B.* Dec. 1915, No. 1290 (*Ed.*).

continuously and progressively ; in a few cases, however, not only did the root weight, and consequently the total amount of sugar increase greatly, but there was also an increase in the percentage of sugar.

4) The beets subjected to continual stripping showed the minimum resistance and keeping qualities, both in the field and in clamp, thus giving evidence of the great disturbance caused in the plants by a repeated removal of their reserve substances.

5) The question of the effect of stripping upon sugar beets was already considered as solved. The results of the present experiments give further evidence that new leaves are produced at the expense of the sugar present in the roots.

In a final note, the writers draw attention to the fact that a clear distinction must be drawn between total *continual stripping* and a *single stripping*, whether total or partial, in the case of beets which show excessive development of top owing to persistent rain. In the latter case, the suppression of a limited number of leaves tends to reestablish the equilibrium between the top and the root, and thus to prepare the plant to resist excessive transpiration in the event of persistent drought, thereby also increaseing the richness of the root. This point is being subjected to further study.

**52 – Experiments on Fertilising Sugar Beets with Manganese.** — FALLADA, O, and GREISENEGGER in *Oesterreichisch-Ungarische Zeitschrift für Zuckerindustrie und Landwirtschaft*, Year 44, No. 5, pp. 379-388. Vienna 1915.

The experiments were made in plots with soil of the same physical and chemical composition. A certain number of cultures without the addition of manganese served as control. To the remainder were added different amounts of peroxide or sulphate of manganese at the rate of 10-20-40-60-120-240 lbs. per acre. Beets of the variety. "Dobrowitzer Original" were sown on May 22, thinned on June 15, June 23 and July 3, and harvested on November 15. Their yield and chemical composition were then determined and allowed of the following conclusions being drawn.

1) Manganese is capable of increasing the yield.

2) It does not appear to have any marked effect upon the sugar content.

3) The effect produced by each form of manganese is limited to a certain quantity of this substance, beyond this the effect is negative.

4) An excessive amount of manganese is more injurious to the root than to the leaves.

5) A large amount of manganese gives rise to a relatively increasing amount of water on the part of the plant.

6) In order to obtain satisfactory results, it is necessary to know the exact amount of manganese required by the plant.

53 – **Air-Layering of the Coffee Plant.** — LAN and FARANT, in *Bulletin Economique de l'Indochine*, Year 19, No. 113, pp. 403-408 Hanoïï-Haiphong, May-June 1915.

Air-layering has proved to be successful for coffee, and should be useful in allowing of more rapid planting. Young plants of *Coffea canephora* var. *koniluensis* were received in March, 1912, by M. FARANT from the Belgian Congo ; they grew rapidly and in three years reached a height of 8 ft. Their rather spreading habit and the necessity of cutting back some interlacing branches suggested the idea of trying air-layering. This was effected at the end of November 1914 by ringing a length of 4 or 5 inches at 5 ft. from the ground and enclosing the base of the shoot in a ball of clayey soil mixed with rotted paddy hulls, tied up in old reed-matting. There was no need to water, as the rains were sufficient. After 2 ½ months, six out of eight of the shoots had rooted ; they were cut off and potted on March 1, 1915, at the latest. Only one layer was slow in picking up, but this flowered like the others and its flowers set successfully.

It is evident that air-layering is extremely easy in the case of this variety of coffee, since the shoots can at the same time put out roots and produce fruit ; this proves remarkable vitality and adaptation to the soil.

54 – **Analysis of Tea Grown in Russia.** — MELIKOR, P. G. and ROSEBNBLAT, M., in *Journale Opitnoi Agronomli* (Experimental Agricultural Review), Vol. XVI, No. 3, pp. 213-216. Petrograd, 1915.

The attempts to introduce the cultivation of tea (*Thea chinensis* L.) along the western littoral of Transcaucasia date back to the first decade of the past century. Notwithstanding the success attending these attempts the cultivation of this plant on a commercial scale has taken place only in recent times and at present in the region of Batum, 1820 acres are under this crop. The conditions of climate and soil are favourable, the average rainfall being about 100 inches, of which most falls during the winter months. The methods of harvesting, drying and fermentation are similar to those in India.

The analytical results of tea grown at "Tchiakva" near Batum are as follows :

| Value in shillings per lb. | I. 5/9 per cent | II. 3/10 per cent | III. 1/6 ½ per cent | IV. 1/6 ½ per cent |
|---|---|---|---|---|
| Moisture | 6.75 | 6.53 | 6.92 | 7.01 |
| Organic matter soluble in water | 33.0 | 32.73 | 31.38 | 33.15 |
| Mineral matter in soluble organic matter | 3.94 | 3.97 | 3.50 | 3.78 |
| Organic matter insoluble in water | 55.00 | 55.73 | 56.17 | 57.76 |
| Mineral matter in insoluble organic matter | 1.30 | 1.37 | 1.63 | 1.60 |
| Ether extract | 7.70 | 3.26 | 7.58 | 2.72 |
| Theïn | 3.22 | 3.00 | 2.64 | 2.26 |
| Tannins | 8.93 | 8.04 | 8.38 | 8.25 |
| Total nitrogen | 7.79 | 7.38 | 3.61 | 3.92 |
| Ash | 5.27 | 5.31 | 5.13 | 5.08 |
| $In_2O_3$ in ash | 7.30 | 3.95 | 3.60 | 3.95 |
| $In_2O_3$ in tea | 0.23 | 0.21 | 0.18 | 0.20 |

It is interesting to note that the amounts of thein, tannin, total nitrogen, organic and mineral matter soluble and insoluble in water in "Tchiakva" tea are similar to those found in China and Indian teas.

Also, this tea being grown in a soil rich in manganese contains a considerable amount of this metal. Further it is interesting to note that the higher priced teas contain more thein: thus the tea at 5/9 per lb. contains 3.22 per cent of thein whilst that at 1/6½ per lb. contains 2.64 per cent.

55 – **Manuring of Cacao at Peradeniya** (1). — BAMBER, M. K. and CORLETT, D. S. in *Department of Agriculture, Ceylon, Bulletin* No. 14, pp. 1-6. Colombo, December 1914.

The plots used in these experiments contain a mixed variety of cacao, Forastero, Caracas and Amelonado, the first named predominating. Many of the trees have been coppiced and are therefore not in full bearing.

Various manures including artificial and organic were applied annually from 1902 to 1911 when all manuring was stopped. The records cover the period from 1906 to 1913.

The conclusions drawn from the results are as follows:

Ammonium sulphate gave the best results for the six years manuring and the yield increased during the first year after manuring had ceased then fell off rapidly. The yield of the potassium chloride plot fell off rapidly after the manuring stopped while potassium sulphate had a more lasting effect. Potassium sulphate and precipitated phosphate gave a marked increase the year after manuring ceased and then fell off to the lowest position.

The effect of fish manure was marked for one year after the manure stopped but the yield then fell off rapidly.

Castor cake alone or with basic slag had a more lasting effect than ground-nut cake alone, or with potassium sulphate.

Blood meal also had a good effect over the two years after the last application, this plot rising to the second place. Trenching and burying organic matter with lime had little beneficial effect, but with basic slag the results were slightly more satisfactory.

The three plots receiving organic manures (blood meal and castor cake alone or with basic slag) gave the best results throughout the whole period and it would appear that this is the best form of applying nitrogen to cacao.

Examination of the rainfall during the years shows that a heavier rainfall during the fruit-setting period June and July results in a heavier crop the following November and December.

56 – **State Control of Tobacco Growing in Montenegro.** — PAVIOLO ITALO in *L'Economia rurale*, Vol. 57, Part 20, pp. 453-455; Part 21, pp. 477-479. Turin, October 25 and November 10, 1915.

State interest in Montenegrin tobacco began in 1903. The formation of a State Department for the control of the tobacco industry was sanctioned by a law passed in that year (slightly amended in 1905) which granted a monopoly to a limited company of Italian capitalists for a period of 25 years

(1) See also No. 121. *B.* August 1915, (*Ed.*).

The object of the Department is to utilise the tobaccos produced in Montenegro, to improve their quality and increase production. The work of cultivation is entrusted to a special Bureau and is carried out in special experiment fields under a technical field staff and with the collaboration of the keenest planters in the best tobacco growing regions.

Amongst other privileges, the Department has the right of fixing the area to be planted in tobacco each year and of determining the quality to be cultivated in each particular locality. The qualities grown are of the kind known as "Turkish" or "Oriental Tobacco". To be more precise the varieties grown are "Xanthi Jaka" ("basma" type) and Herzegovina (bascibagli type with the 3 sub-types "Podgoritza", "Kraina" and "Giant Herzegovina").

The seed is sown on a cold bed between the second fortnightof January and the first of February. The young plants are planted out in May. The leaves are picked and dried from the end of July till the middle of September. With the advent of the first autumn rains the leaves are classified and baled, and usually at the beginning of November the product is ready for delivery.

As soon as the crop is sufficiently far forward to allow of an estimate of the crop, the Direction of the monopoly is able to make, when required, loans for purposes of cultivation up to half the value of the estimated yield. The Administration generally begins buying on November 1; purchases are made according to type-samples and tariffs previously arranged by the Government. The tobacco when bought is consigned to the depôts of the Bureau mentioned above, where it is selected, packed and allowed to ferment (for a period of 5 to 11 months according to the particular type); it is then passed on to the maturation sheds and storehouses, subsequently being sent to the factory or sold crude for export. The tobacco is generally ready towards the middle of September of the year subsequent to that in which it is taken over from the growers.

The amount of tobacco acquired annually from the growers is about 285 tons, the price paid being about 2 ½ *d.* to 4 ½ *d.* per lb. The local unit of area, the *rallo* (about 2165 sq. yds.) produces for consignment on an average, 286 lbs of leaves worth £4 3*s.* but, actually, the average production is about 385 lbs. per *rallo*.

The factory uses chiefly tobacco supplied by the Agency, but it also accepts produce from outsiders. All the manufactured products pass into the maturing sheds and thence to the central warehouse whence they are despatched abroad, or to the 5 distributing stations of the Realm (Podgoritza, Cettigne, Niksich, Kolascin and Antivari).

57 – **The Economical Production of Mulberry Leaves.** — *Informazioni seriche, Rivista dell'industria bacologica e serica*, Year II, No. 23, pp. 607-608, Figs. 2, Rome, November 5, 1915. VARIOUS CROPS

With the assistance of funds established by the Law for the development of sericultura in Italy (1) various agricultural institutions have established mulberry plantations either of the bush or field type.

(1) See ORESTE BORDIGA « The Crisis in Italian Sericulture and the Measures for Averting it ». *B.* Oct. 1914, pp. 1263-1270. (*Ed.*)

Among these institutions are the Travelling Schools of Agriculture for the provinces of Alexandria, Bergamo, Como, Cremona, Cuneo, Milan, Novara, Padua, Parma, Piacenza, Udine and Verona.

The reports of these institutions to the Ministry of Agriculture and Commerce, examined by the Council having charge of sericultural interests enable the following statement to be made regarding the method of planting.

Small wild mulberries were used or the variety Morettiano, or Trentin one year old and, less often, two year old seedlings. Plants with leaves too much lobed were excluded and, for economical systems of silkworm breeding in which leaves are fed without being detached from the branches, preference was given to the kinds with thick stiff paper-like leaves as being less liable to wither.

The plantations were generally made in the spring on land ploughed to a depth of 20 to 24 inches and manured generously. The planting distances adopted were 20, 24 and 28 inches (more rarely 31 to 39 inches) between the rows on the square or quincunx system with 10 to 34 inches between the plants.

After planting the plants are generally cut down to the level of the ground, this results in a vigorous growth the following year with a crop in the second year often exceeding 80 cwt. per acre.

The establishment of such plantations is technically a simple process but care should be taken in the cultivation and manuring. Direct sowing followed immediately afterwards by thinning out of the seedlings is recommended in the more fertile or irrigated lands and when more regular branching is desired.

The greatest care should also be taken to guard against weeds. It is advisable therefore to sow in rows about 30 inches apart.

The management of the plantation is also easy, but generous manuring is desirable with a high proportion of nitrogen.

Most cultivators believe in the future of this field method of cultivation not only in connection with economic systems of mulberry cultivation but also in respect of quantity of crop produced in such a short time ; the facility, rapidity and economy of the harvest either by the ordinary method of defoliation or by cutting the branches to the ground ; the easy control of *Diaspis* ; and the advantage of an unmixed crop.

At the same time it is considered that there it is still place in such a system for standard, half-standard and pollarded trees as in this way leaves of various qualities and degrees of maturity may be obtained, not to mention a more economic use of the land.

The exclusive use of this system, however, would be a serious mistake in zones of intensive cultivation and where the price of land is high, as it would occupy too large an area.

The quality of the leaves obtained in the few experiments made was good.

The dangers of this method consist in the increased liability to damage

by frost, especially late frosts, and root rot. No special diseases have as yet been noted.

Longer observations are required before it will be possible to determine the life of this form of plantation. Generally from 8 to 10 years of intense production is maintained but in the province of Bergamo there is a 20 year old plantation which gives promise of profit for a further period of 5 years.

58 – **Yields of Native Prickly Pear in Southern Texas.** — GRIFFITHS, D. (Agriculturist, Office of Farm Management). *Bulletin of the U. S. Department of Agriculture*, No. 208 (Contribution from the Bureau of Plant Industry), pp. 11, pl. I-II. Washington, May 13, 1915.

In order to furnish information about the handling of prickly pear on an economic basis, observations and tests were made with plantings at San Antonio as well as Brownsville, Texas. These two localities are representative of the coastal region of heavy rainfall and of the more inland situation of much more uncertain distribution of moisture.

*Summary of yields of native prickly pear grown from cuttings or old stumps.*

| Time harvested | Character of cultivation | Cutting or stumps | Yields per acre per annum | Species grown |
|---|---|---|---|---|
| | | | *Tons* | |
| *at Brownsville* | | | | |
| October, 1909 | Good | Cuttings | 50.32 | *Opuntia gommei* and *Opuntia cyanella* |
| do. | do. | do. | 38.42 | Unnamed |
| do. | do. | do. | 42.75 | Mission |
| Oct. 21 to Dec. 27, 1911 | do. | Stumps | 106.843 | *Opuntia gommei* and *Opuntia cyanella* |
| Dormant seasons of 1912–13 | Good for two seasons; none thereafter | Cuttings | 40.314 | Mainly *Opuntia gommei* and *Opuntia cyanella* |
| *at San Antonio* | | | | |
| October, 1907 | None | Cuttings | 2.83 | *Opuntia lindheimeri* |
| April and May, 1909 | Very poor | do. | (1) | do. |
| April, 1910 | do. | do. | 14.32 | do. |
| March, 1911 | None | do. | 5.89 | do. |
| March, 1913 | Poor | do. | 20.685 | *Opuntia lindheimeri* mostly |
| April, 1914 | do. | Stumps | 28.00 | *Opuntia lindheimeri* |
| Spring, 1914 | None | do. | 9.8 | do. |

(1) Roughage for 1 cow on 1 1/5 acres.

It is shown that other conditions being equal, the yields of prickly pear at a particular place have generally been in direct proportion to the care given the plantation. The most potent factor after the plants are once

thouroughly established is cultivation. The prickly pear does not seem to require anything like a dust mulch or deep cultivation, such as is so commonly practised with other crops in dry regions. All that experience seems to indicate as necessary is to keep down the weeds, which interfere with the growth of the pear the same as with any other crop. Shallow cultivation appears to be sufficient, but, owing to the fact the our plantations at San Antonio have at times become very weedy, a shallow furrow has been turned toward the rows and subsequently levelled with a spike-tooth cultivator. In the two situations, the maintenance of a dust mulch has not seemed necessary even in the driest seasons.

In one of the varietal plantings at Brownsville, established upon an old Bermuda-grass sod, a good dust mulch of 2 to 4 inches seemed to be very detrimental, dealing with a loam in a perfect state of tilth for two years. Under this treatment there was a constant and abundant supply of moisture in the soil. The growth of all species was very rapid for a short time, but they soon rotted off at the surface of the ground, and this condition continued at an alarming rate for two or three seasons after the establishment of the plantation. The spineless and introduced species suffered most, but the native species rotted off also. They simply fell over and took root again on top of the ground, thus becoming reestablished and still making a phenomenal growth. Under these humid conditions a deep dust mulch was decidedly detrimental. Treatment which allowed the soil to dry out more readily was productive of better results. In short, upon the heavier lands of southern Texas, represented by the regions in which this work has been done, a dust mulch does not seem to be essential, but it is necessary to keep down the weeds and give sufficient cultivation to allow a good penetration of moisture at the time of rainfall.

At Chico, California, where the summers are long, hot and dry, all species except those from the driest deserts have withered badly when weeds were not kept out, but when cultivated sufficiently to keep them down no wilting occurs. The desert forms have shown no signs of withering at Chico, even when no cultivation or irrigation was given. Even with poor cultivation, plantings of native prickly pear at Brownsville have never suffered from drought, although the same plants occasionally wither in the brush in the vicinity. At San Antonio the poorly cared for and weedy plantings were often considerably withered. The cultivation there has never been sufficient to do much in the way of conserving moisture, but has usually been enough to cause a good penetration of the rainfall. When no weeds were present the evaporation of this rainfall from a poorly cultivated surface has not caused the plants to wilt.

MARKET GARDENING

59 – ***Chenopodium quinoa* in Columbia.** — *República de Colombia, Revista del Ministerio de Obras Públicas* (Sección de Agricoltura, Colonización e Immigración) Year VIII, No. 12, pp. 717-719. Bogotá, December, 1914.

The Ministry of Public Works of Columbia has initiated experiments on the introduction of *Chenopodium quinoa* ("quinua") from Peru and its acclimatisation in the cooler regions of the country. For this purpose seeds have been obtained from the Columbian Minister at Lima (Señor Eduardo

Restrepo Saenz). Seeds obtained in 1913 did not germinate and another consignment was dispatched in 1914 accompanied by the following information :

*Ch. quinoa* grows to a height of 1 metre or more, with lanceolate leaves, large bunches of greenish flowers, spherical seeds about the size of millet and yellowish white in colour. The leaves constitute a useful vegetable but the seeds are the most important crop. They are largely used in the Sierra del Peru and frequently form the basis of the daily rations.

The cultivation of the plant is easy, its yield very considerable and its requirements limited. Mountain land is generally used. On the Cordilleras it is cultivated to a height of from 10 000, and according to some up to an elevation of 12 000 feet. Sowing takes place at the beginning of the rainy season in clay and calcareous soils without either manure or irrigation. The Indians often combine this crop with potatoes, maize, etc. The mature fruiting stems are cut, left to dry, and threshed by hand to liberate the seeds from the capsule. The seeds should then be carefully washed, macerating for 24 hours in cold water changed several times to prevent the water from becoming bitter or from foaming when shaken. This removes the bitter flavour which would render the seeds uneatable. The water is subsequently used for washing woollen garments.

The washed grains are then boiled and sold in this form in the markets of Peru. They may be eaten as they are or with the addition of salt or condiments or prepared in various ways. An alcoholic drink is also made from it by fermentation.

The cooked grains are an excellent food for poultry and for those of fastidious taste, such as turkeys.

It is suggested that this plant is worthy of acclimatisation and distribution in Europe is well as in America.

60 – **Frost Protection for Fruit and Vegetables.** — See No. 5 above.

FRUIT GROWING

61 – **Pollination of Fruit Trees : Observations and Experiments from 1904 to 1912.** — MIDDLEBROOKE, W. J. in *The Journal of the Board of Agriculture*, Vol. XXII, No. 5, pp. 418-433. London, August, 1915.

The theory of pollen sterility, *i. e.*, the inability of certain varieties of fruit to fertilise themselves and produce fruit, has not yet been completely established.

Sterility cannot be attributed to close in-breeding, as most of the varieties of fruit trees in cultivation originated in chance seedlings, the parentage of which is unknown, and little effort has been made to produce strains or fixed types of fruit trees as in the case of flowers and vegetables. Neither can sterility always be attributed to impotent pollen : many other agents may be responsible for the destruction of fruit crops during the flowering period.

In these experiments the following methods of pollination were used.

1. *Hand pollination by means of a brush* ; a separate brush being used for each variety of pollen employed.

2. *Pollination by bees.* In 1910 a stock of bees was introduced into the orchard house and allowed to remain until all kinds had flowered.

3. *Pollination by wind.* The wind was simulated by means of bellows and by shaking the trees. The trees were isolated by means of muslin screens on a framework of light canes. Suitable trees of small size were selected for the purpose, and a uniform number of fruit buds were left on each tree.

The results of these experiments were very successful from a practical point of view as only about 5 per cent of the trees failed to set a sufficient quantity of fruit for a crop and no trees were entirely barren.

The introduction of bees was a failure as far as the currants and gooseberries were concerned as the bees preferred to live on the honey in the hive. The pollination of the other fruits was not so good as in the case of artificial pollination, probably owing to the numerous kinds of fruits in bloom at the same time. The blossoms of stoned fruits were preferred to the other kinds. It was also observed that the bees worked newly opened flowers for honey collection and that the pollen was collected separately or by special bees. The only other insect which took part in the pollination was a small dark coloured bumble bee which worked more effectively than the ordinary bees. Pollination was most effective on days with intervals of cloud and sunshine with a warm and slightly humid atmosphere. On dull, cold days and abnormally hot days pollination was ineffective.

The wind pollination gave good results. Out-door fruit was observed to set fruit more freely with gentle breezes of wind and occasional showers of rain and a sufficiently warm atmosphere.

*Table showing Results obtained with different fruits by Cross-Pollination as compared with the Pollination by the Varieties' own Pollen and Mixed Pollen taken from various Varieties indiscriminately.*

(The figures represent the percentage of fruit set and remaining on the trees at the time of thinning, the fruit being of considerable size and securely fixed. The results are from experiments carried out for five years in succession (1907-1912). The trees were established in pots and fruited under glass without artificial heat.).

| *Apples.* | |
|---|---|
| Own pollen | 9.20 |
| Mixed pollen | 14.54 |
| Allington Pippin | 15.62 |
| Beauty of Kent | 14.30 |
| Belle Pontoise | 16.76 |
| Bismarck | 16.48 |
| Cellini | 14.38 |
| Cox's Pomona | 12.76 |
| Devonshire Quarrenden | 16.53 |
| Dutch Mignonne | 17.66 |
| Golden Spire | 16.87 |
| James Grieve | 16.21 |
| Jonathan | 16.00 |
| King of Tompkins County | 16.26 |
| Kings Acre Bountiful | 19.23 |
| Margil | 14.40 |
| Newton Wonder | 14.62 |
| Scarlet Nonpareil | 18.00 |
| The Queen | 15.81 |
| Washington | 16.89 |
| Wealthy | 14.19 |
| Worcester Pearmain | 15.06 |
| *Pears.* | |
| Own pollen | 8.97 |
| Mixed pollen | 16.70 |

| | |
|---|---|
| Bergamotte Esperen | 15.92 |
| Beurré Clairgeau | 17.00 |
| Beurré Hardy | 17.00 |
| Beurré Rance | 15.85 |
| Beurré Superfin | 17.00 |
| Bon Chretien (Williams) | 16.66 |
| Conference | 17.60 |
| Dr. Jules Guyot | 19.71 |
| Emile d'Heyst | 16.14 |
| Louise Bonne of Jersey | 18.00 |
| Marie Louise d'Uccle | 14.88 |
| Nouveau Poiteau | 17.40 |
| President d'Osmonville | 17.43 |
| Princess | 15.85 |
| St. Luke | 19.00 |
| Triomphe de Vienne | 20.44 |
| Vicar of Wakefield | 14.40 |
| Klondike (not in commerce) | 17.00 |
| Charles Ernest | 17.07 |

*Apricots.*

| | |
|---|---|
| Own pollen | 17.14 |
| Mixed pollen | 25.85 |
| Kaisha | 29.83 |
| Moor-park | 27.33 |
| Oullins Early | 32.33 |

*Nectarines.*

| | |
|---|---|
| Own pollen | 13.53 |
| Mixed pollen | 17.84 |
| Cardinal | 18.20 |
| Dryden | 22.00 |
| Goldoni | 21.80 |
| Pine Apple | 20.40 |
| Spenser | 18.75 |

*Peaches.*

| | |
|---|---|
| Own pollen | 15.35 |
| Mixed pollen | 18.74 |
| Condor | 18.00 |
| Crimson Galande | 22.81 |
| Dr. Hogg | 21.54 |
| Duke of York | 23.40 |
| Dymond | 20.88 |
| Early Grosse Mignonne | 20.12 |
| Golden Eagle | 22.00 |
| Late Devonian | 19.50 |
| Peregrine | 23.92 |
| Royal George | 21.80 |
| Sea Eagle | 21.12 |
| Thomas Rivers | 23.12 |

*Cherries.*

| | |
|---|---|
| Own pollen | 18.07 |
| Mixed pollen | 30.50 |
| Frogmore Early Bigarreau | 29.57 |
| Governor Wood | 31.00 |
| Knight's Early Black | 29.66 |
| Late Duke | 26.66 |
| Morello | 25.50 |
| Werder's Early Black | 27.60 |
| Gean or Wild Cherry | 26.72 |

*Plums.*

| | |
|---|---|
| Own pollen | 11.10 |
| Mixed pollen | 16.32 |
| Blue Rock | 18.75 |
| Count Althan's Gage | 15.00 |
| Denniston's Superb | 15.50 |
| Early Prolific | 14.00 |
| Grand Duke | 15.20 |
| Heron | 17.54 |
| Jefferson | 13.53 |
| Late Orange | 13.60 |
| Mallard | 16.53 |
| Monarch | 16.77 |
| Oullins Golden Gage | 14.00 |
| Pond's Seedling | 15.71 |
| Prince of Wales | 15.00 |
| Swan | 19.43 |
| Curlew | 16.37 |
| Cox's Emperor | 15.50 |
| Coe's Golden Drop | 13.51 |

These results represent the pollination of 17 varieties of apples, 48 pears, 7 apricots, 13 nectarines, 14 cherries, 31 peaches and 39 plums. In calculating the results every flower in each truss of bloom was taken into account. The average numbers of flowers in a truss was as follows : Apricots, 3 to 5 ; apples 5 to 7 ; cherries, 15 to 25 ; nectarines and peaches, 2 to 5 ;

pears, 9 to 12 ; plums, 3 to 9. It was invariably found that the first flowers of a truss that opened were fertilised and began to swell immediately, while the remaining flowers of the truss, although pollinated did not swell ; the stalk and embryo-fruit turned yellow and fell off.

Experiments with cider apples showed that in grass orchards planted with standard trees, cider varieties, planted among culinary and dessert apples would have a beneficial effect on the cropping of the latter. The following varieties of early flowering cider apples were tried and recommended : Bedan des Parts (April), Cherry Hereford (middle May), De Bout-teville (early May), Eggleton Styre (middle May), Handsome Hereford (middle May), Médaille d'Or (early June), Rouge Bruyère (early May), Sam's Crab (April), Skyrme's Kernel (end of May), Strawberry Hereford (Middle May), White Hereford (early May). All these varieties are extremely prolific.

The best form of tree for pollination experiments is the single cordon grafted or budded on suitable stocks.

With grapes there was a tendency for the pollen of all varieties to set freely, except in the case of Muscat Hamburgh which showed a preference for the pollen of Black Alicante or Black Hamburgh. Cases of bad setting were generally found to be due to the presence of a little drop of nectar hanging on the end of the pistil, which prevented the pollen from doing its work. The nectar was removed by syringing the bunches early in the day with clean warm water (5° F. above that of the house). When dry the bunches were stroked downwards with the hand and afterwards shaken. Very good results were obtained in this way.

The best results with currants and gooseberries under glass were obtained by placing the bushes exposed to the wind from the ventilators and where a cooler temperature could be maintained.

62 – **Contribution to the Physiology and Technique of the Forcing of Woody Plants.** — La Marca, F. in *Le Stazioni sperimentali agrarie italiane*, Vol. XLVIII, Part 10-11, pp. 772-782. Modena 1915.

The writer reviews the methods of forcing woody plants to obtain early fruits as proposed by Weber (acupuncture of buds and injection of special reagents), Portheim and Kulm (acupuncture, hot water baths, removal or suppression of the bud scales), Molisch (hot water baths or hot air) improved by Howard and Johannsen, and of those based on the use of anasthetics. The writer carried out experiments at the Royal College of Agriculture at Portici (Naples) with the object of improving arboricultural practice. The experiments were carried out on varieties of apples and a vine (Palumbo stock) using the following methods of forcing : 1) separation of the scales ; 2) complete removal of the scales ; 3) simple pricking with a needle; 4) injections of distilled water; 5) 20 per cent solution of quinine sulphate ; 6) sulphate of iron ; 7) sulphate of nickel ; 8) sulphate of copper, these methods were tried both alone or in combination.

All the buds treated opened earlier than the controls, by a period varying from 9 to 21 days and in the large majority of cases by a period

of 2 weeks. The same advance was shown in flowering and in the swelling and ripening of the fruits.

The writer concludes that the accelerating action of the budding of plants may be attributed almost exclusively to the lesions produced on the bud either by simple needle puncture or by the separation or suppression of the scales or possibly even by injections. Probably the greater aeration of the interior of the buds and the diminution of the pressure exercised by the envelope of scales can also have some influence though it is only a minimum one.

Injections and needle punctures give almost equal results but the latter method is preferable in practice (effected on the middle part of the base of the bud, on the leaf scar) and its technique more simple.

63 – **Methods of Encouraging Cider Apples to Bear Every Year.** — TRUELLE, in *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. I, No. 19, pp. 597-602. Paris, October 20, 1915.

Methods of encouraging every-year bearing of cider-apples are classified by the writer in four categories: 1) selection of variety; 2) suppression of flowers; 3) manuring with phosphates and potash; 4) root-pruning and lifting of the trees.

1) *Selection of varieties.* — There are two ways of effecting this, both derived from direct observation. The first, which seems the best, consists in choosing grafts from healthy trees showing abundant promise of fruit for the year of grafting. It is sufficient to choose trees which are laden with fruit when nearly all the rest are in their off-year, and which have shown regular alternation in bearing for some years.

The second method is based on the choice of varieties whose leaves open before the flowers, providing them with food reserves, and in trying to fix this course of vegetation in the varieties which show this tendency, or some inclination to acquire it.

2) *Suppression of the flowers.* — This very ancient practice would be almost impossible in the case of large appple and pear trees. It is then necessary to have recourse to destroying the flowers by the application of a corrosive spray, *e. g.* a 3 per 1000 solution of sulphate of iron; this does not injure the leaves, but destroys the stamens and pistils; it must be applied as soon as the flowers begin to open and before fertilisation takes place.

3) *Manuring with phosphates and potash.* — A fertiliser consisting of 4 ½ lbs. of superphosphate and 2 ¼ lbs. of sulphate of potash per rod spread in the year of general bearing of the other trees of the orchard, is advised for trees temporarily barren after some years of bearing. It should be followed by a further dressing of 1 ¾ lb. of superphosphate and about 1 ½ lb. of sulphate of potash per rod in subsequent years.

4) *Root-pruning and lifting the trees.* — Root-pruning generally leads to marked decrease in vigour of growth in the following year, with increased formation of fruit buds. It may be combined with lifting so as to prune the large roots more thoroughly; but it is only likely to be successful for trees 10 to 15 years old.

64 – **Apple Breeding.** — See No. 30, above.

65 – **The Possible Utilisation of a Wild Species of *Anacardium* in Brasil.** — De Moraes, Paschoal, in *Chacaras e Quintaes* Year VI, Vol. XII , No. 4, p. 255. São Paulo, October 15, 1915.

Cajueiro (*Anacardium* sp.) is one of the commonest trees in Brazil, where it is indigenous and is often found in the wild state, especially in the north-west of the country. Its uses are numerous : tannin from its bark ; wood-work and clogs ; resin as a substitute for gum arabic, over which it has the advantage of not being hygrometric ; its fruit in the green state is suitable for culinary purposes, and being of agreeable taste and nutritious, it might, if preserved, form the basis of a large industry. The nut of the ripe fruit contains a kernel of the following composition : fats, 47.13 per cent ; nitrogenous matter, 9.7 per cent and starch, 5.9 per cent. Under the name of "East Indian almonds" it is used in place of almonds and nuts in confectionery. The pulp of ripe fruit known as "cajù" is used for making fermented drinks, fruit paste and candied fruits. At present use is only made of a very small part of the wild fruits —The yield is enormous and reaches about 3000 fruits per adult tree between November and February ; the number of trees in the coastal and continental portion of Brazil is estimated at more than 500 millions.

66 – **Botanical Characters of the Leaves of the Date Palm Used in Distinguishing Varieties.** — Mason, S. C. (Arboriculturist, Bureau of Plant Industry) in *U. S. Department of Agriculture Bulletin* No. 223 (Professional Paper), pp. 1-16, Plates I-V. Washington, D. C. June 23, 1915,

The use of fruiting characters alone in determining the varieties of dates has considerable disadvantages particularly in the case of male and immature trees. To overcome this difficulty the writer suggests the following foliage characters as a basis of classification :

Colour of foliage and epidermal characters.

Curve of the rachis : graceful or stiff.

Pinnae : mode of insertion, whether introrse, extrorse or antrorse ; dimensions, length, breadth and thickness ; axial divergence in both horizontal and vertical plane ; percentage of spines.

This system is applied to the description of the following varieties of dates : Deglet Noor, Hayany, (Birket el Hadji), Menakher and Thoory.

67 – **The Washington Navel Orange.** — Shamel, A. D. (Physiologist, U. S. Dep. of Agriculture, Riverside, Cal.) in *The Journal of Heredity*, Vol. VI, No. 10, pp. 435-445, 6 figs. Washington, October 1915.

This paper is an attempt by the writer to bring together the available information concerning the origin and development of the Washington Navel variety. The historical data relating to its origin and development in Brazil were collected by an expedition sent to that country by the U. S. Department of Agriculture in 1913 which included the writer.

The Washington Navel orange originated at Bahia, Brazil, as a bud sport from the Portuguese variety "laranja selecta" undoubtedly introduced by the Portuguese into Brazil very soon after the colonization of

that country. The variation was discovered and first propagated by a Portuguese gardener at Bahia in 1822.

From the first the seedless fruits of the navel orange called in Brazi " laranja selecta de umbigo " were highly prized by the Bahians, the variety spread rapidly and at the present time it has practically supplanted all other varieties of oranges grown in Bahia, with the exception of a sour or bitter variety called " laranja di terra " (*Citrus vulgaris* Risso) which is grown for the production, of seeds used for raising stocks. Near Rio de Janeiro commercial orchards of the " laranja selecta " variety are still cultivated and in them cases of limb sports bearing typical navel orange fruits were observed.

At the time the expedition visited Brazil, it found growing at Bahia about 50 000 bearing navel orange trees and about as many more below the bearing age. The trees are usually planted at the rate of about 100 per acre. The development of this industry has been encouraged by the Brazilian Government and particularly by the city of Bahia which has established an experimental farm for the purpose of investigating methods of propagation, culture and handling oranges. The municipality of Bahia within the territory of which there are about 35 000 acres of land suitable for planting oranges, makes great efforts to encourage an export trade particularly to the larger cities of South America. But even the city of Bahia itself is a good market, the fruits retailing there at an average of about 3 cents each. The expense of clearing the land, planting the orchards, and bringing them into bearing is frequently made up by the profits from the culture of manioc between the rows of trees. The bearing orchards are cultivated by scraping off the weeds from one to three times a year with a heavy hoe or " enchada ". About the only fertilizer used is barnyard manure. Insect enemies and fungus diseases are not controlled artificially except in the case of ants (destruction by digging or, recently, by fumigation).

The navel orange orchards at Bahia are given no irrigation, the annual rainfall being about 50 inches. The principal crop ripens in May, June and July (winter months). Another crop ripens in December, January and February, while on some trees ripe fruits are found all the year round.

The Bahian navel orange was introduced into the United States through the efforts of the late WILLIAM SAUNDERS, horticulturist for that division of the Patent Office corresponding to the present U. S. Department of Agriculture. A first shipment of these trees was made in 1868 but during the long voyage they died. A second shipment made in the following year was successful. When the trees were ready for distribution in 1873, two were send to a Mrs Tibbets, who resided in Riverside, Southern California, and most of the remainder to Florida, which was thought to possess more nearly ideal conditions for the growth of this variety. But while this orange proved superior in many respects to any then grown in Southern California, in Florida it turned out somewhat unsatisfactory particularly on account of low production in comparison with other varieties grown there, and has never achieved any great commercial success in that State.

Mr. SAUNDERS distributed this variety under the name of the "Bahian Navel Orange", but subsequently the growers united upon the name of "Washington Navel Orange".

The general introduction and development of the navel orange industry in California has occurred within the last forty years. At present there are about 100 000 acres of this variety cultivated in the State and the production is about 10 000 000 boxes per year. From California trees of this variety have been sent to Japan, Australia, South Africa and other foreign citrus districts. In those regions the variety has become commercially important and its culture is being rapidly extended, so that it is becoming one of the leading citrus varieties of the world.

In California the Washington Navel is usually budded upon stocks from the Mission Sweet Seedling oranges. In some districts it has been propagated upon stocks grown from grape fruit, the Florida sour orange, and the Floida rough lemon seeds.

In 1909 the writer began a series of observations on the behaviour of this variety under different soils and climatic conditions in California. In the study of these trees, it was found that numerous diverse types of trees and fruits existed, and that frequently trees grown from a single navel orange bud produced several characteristic types of fruit. In some cases this variation was found to occur as limb sports. In other cases these variations were found as single fruits.

Systematic investigation was begun by the writer with the object of discovering the extent and importance of the diversity of types arising from bud mutations. Plots of about 110 trees each were selected in representative orchards and careful performance records secured from each tree in these plots. After six years systematic study, conclusions can safely be drawn that the diverse types of the navel orange existing in California have originated from bud sports. The trees of these types have characterictic habits of growth and the fruits borne by these trees are of very widely differing commercial value.

The occurrence of these diverse types is very much more frequent than has heretofore been supposed. One of the characteristics of some of the unproductive and undesirable types of trees is unusual vigour of growth. Frequently these trees stand out in orchards several feet in height above the neighbouring trees and have also a greater spread. They also frequently produce an unusual number of suckers, which vigorous vegetative growth was highly prized for propagation, and has caused an increasingly large proportion of deterioration in the characters of production of the variety. Performance records have been kept for some years, the undesirable types have been successfully top-worked using budwood from select trees of the best types.

Some of the leading nurserymen have adopted the principle of propagation from select trees, propagating only from those trees producing large, regular and valuable crops as shown by actual performance records. It has been commercially demonstrated that a valuable type of the navel orange can be isolated through bud selection based on performance records

and that the variation in this type can be controlled by bud selection so that by this means the variety can be conserved, maintained and improved.

The limb selections are done by cutting the budwood from the select trees with the ripe fruit attached and using only budwood of the preceding year's growth from the limbs which produce the typical fruit. This wood while it is of small size has been successfully used commercially. It produces equally good, if not better, trees than those propagated from the larger and more rapidly growing wood.

In the orange districts of Bahia a tree renewal is practised by the growers. After 15 or 20 years the tree tops are cut off and new tops grown from the old trunks. The trees are either cut back severely to a point just above the bud union or only the smaller limbs are cut off. The amount removed is governed by the condition of the trees. The renewed trees were found to be surprisingly healthy, vigorous growing and productive. Some trees were found to have been renewed as many as four times, indicating that the trunks were from 60 to 80 years of age.

Another interesting practice observed in the Bahian navel orange districts was the budding of stocks set in permanent orchard places, whilst in the past the general method followed was that of the ordinary nursery; for the former system it is claimd that a more rapid growth of the tree, earlier fruiting and greater resistance to disease are ensured than with the ordinary transplanted nursery trees.

Bud variations were found in the Bahian navel orange, but apparently are not so frequent as in the California Washington Navel orange trees. Distinct types of trees were observed in all the orchards examined. On individual branches leaf variations and especially of the petiole were very frequent. Among the variations of the fruit the typical flattened and wrinkled so-called Australian navel fruits was found as well as reversions to the "laranja selecta".

Variability in the time of ripening fruits, size, shape, navel characters, colour and other characters was particularly marked. Most of the types of navel oranges found in California were observed in the orchards of Bahia.

58 - **Studies and Observations on Direct Producers in Poitou, France.** — MAGNON, A. in *Le Progrès agricole et viticole*, Year 32, No. 45, pp. 444-447. Montpellier, November 7, 1915. VINE GROWING.

Since 1894 the writer has cultivated some hundreds of direct producer hybrid vines in his vineyards and experimental fields. Observations of these vines indicate their behavious under the conditions in Poiton, where the land is hilly and the soil dry and calcareous.

The varieties are classed as follows:

VARIETIES REQUIRING NO TREATMENT IN NORMAL YEARS.

*Red grapes:* Gaillard No. 2; Gaillard No. 194; Couderc 503 (Oiseau bleu); Couderc 4401 (Oiseau rouge);

*White grapes:* Bertille-Seyve 450.

VARIETIES REQUIRING ONE OR TWO COPPER SPRAYS EARLY IN THE SEASON.

*Red grapes:* Seibel No. 1; Seibel No. 128; Seibel No. 2003; Seibel No. 2006; Bertille-Seyve 618; Seibel 2007.

*White grapes:* Gaillard 157 (Roi des blancs); Seibel 4574; Castel 1028; Couderc 343-14.

69 – **Baco's Vine Hybrids in Charente, France.** — PETIT, VICTOR in *Le Progrès agricole et viticole*, Year 32, No. 45, pp. 442-444. Montpellier, November 7, 1915.

The writer describes the good results obtained in several years' tests with two hybrid vines of the BACO collection, with regard to yield of fruit, the quality of the vines and resistance to fungi and phylloxera.

The two hybrids are:

*Baco* (24-23) No. 1. Folle blanche × Riparia; fruit red.

In 1915 this hybrid gave very good results without either copper or sulphur sprays. Vines with long runners grown on the double Guyot system, the oldest being 5 years, yielded from 70 to 100 bunches of a total weight of 11 to 15 1/2 lbs and the yield of must was 8 gallons per 100 lbs of grapes.

*Maurice Baco* (22 A). Folle blanche × Noah; fruit white.

The resistance of this hybrid to fungoid diseases and phylloxera is so much superior to that of Noah that in ordinary years it merely requires spraying once with coppers alts with occasionally a sulphur dusting, in unfavourable years two light copper sprayings are necessary. Further, it does not require to be grafted. Neither is there any danger from vine rot (*Botrytis cinerea* Pers.) nor from the fall of the fruit at maturity.

The analyses of the wine of these two hybrids gave the following results:

| Baco No. 1. | | | Maurice Baco. | |
|---|---|---|---|---|
| Density | | 1091.7 | Alcohol, per cent by volume | 13.7 |
| Extract at 100° | gms. | 235.90 | Houdart extract per 1000 gms. | 30.8 |
| Ash | " | 3.76 | Acidity ($H_2SO_4$) per 1000 gms. | 7.9 |
| Sugar (Fehling) | " | 214.50 | Reducing sugar per 1000 gms. | 9.85 |
| Alcohol, per cent by volume | " | 12.5 | | |
| Acidity ($H_2SO_4$) | " | 7.12 | | |
| Tannin | " | 0.615 | | |

FORESTRY

70 – **The Growth of the Black Poplar in Tuscany and its Utilization.** — SOMMA, U. in *L'Agricoltura italiana*, Year XI (Fifth series) Part 18-19, pp. 411-420. Pisa, September 30-October 16, 1915.

Following the same methods adopted in his investigations on the growth of black poplars in the Tuscan Appennine at a height above sea level of between 1300 and 1600 feet (1), the writer has now studied their growth in the same locality (Commune of Vernio, province of Florence) but at a height of 2460 feet and comparatively at a height of 230 feet above sea level. The results obtained are shown in Table I:

(1) See *B.* Dec. 1915, No. 1305. (*Ed.*)

TABLE I. — *Average yearly increment, for quinquennial periods, of the diameters of black poplars.*

| At a height of | 0.98 ft. | 10.82 ft | 20.66 ft. | 30.50 ft. | 40.34 ft. | 50.18 ft. |
|---|---|---|---|---|---|---|
| | *At an altitude of 2460 feet,* | | | | | |
| | inches | inches | inches | inches | inches | inches |
| At the age of 26–25 years | 0.31 | 0.35 | 0.43 | 0.51 | 0.51 | 0.55 |
| » » 25–20 » | 0.33 | 0.40 | 0.52 | 0.55 | 0.58 | 0.61 |
| » » 20–15 » | 0.41 | 0.51 | 0.61 | 0.56 | 0.55 | — |
| » » 15–10 » | 0.41 | 0.46 | 0.67 | 0.51 | — | — |
| » » 10– 5 » | 0.41 | 0.41 | 0.59 | — | — | — |
| » » 5– 0 » | 0.27 | — | — | — | — | — |

| At a height of | 0.98 ft. | 14.10 ft. | 27.22 ft. | 40.34 ft. | 53.46 ft. | 66.58 ft. |
|---|---|---|---|---|---|---|
| | *At an altitude of 230 feet.* | | | | | |
| | inches | inches | inches | inches | inches | inches |
| At the age of 24–20 years | 0.47 | 0·64 | 0.70 | 0.81 | 0.60 | 0.57 |
| » » 20–15 » | 0.51 | 0.66 | 0.83 | 0.80 | 0.69 | — |
| » » 15–10 » | 0.57 | 0.63 | 0.78 | 0.70 | — | — |
| » » 10– 5 » | 0.59 | 0.63 | — | — | — | — |
| » » 5– 0 » | 0.55 | — | — | — | — | — |

TABLE II. — *Height increment of black poplar.*

| Number of wood rings at the various heights | | Average yearly | Average quinquennial |
|---|---|---|---|
| heights in feet | Number of wood rings, age of plant years | increment in height | increment in height |
| | *At an altitude of 2460 ft. above sea level* | | |
| 0.98 | 26 | during the first 6 years . 1.64 ft. | from 0 to 5 years . . 8.20 ft. |
| 10.82 | 20 | » the next 5 » . 1.97 » | » . 5 » 10 » . . 9.51 » |
| 20.66 | 15 | » » 3 » . 3.28 » | » 10 » 15 » . . 14.27 » |
| 30.50 | 12 | » » 4 » . 2.46 » | » 15 » 20 » . . 12.30 » |
| 40.34 | 8 | » » 4 » . 2.46 » | » 20 » 25 » . . 10.33 » |
| 50.18 | 4 | » » 4 » . 1.80 » | |
| 57.40 | 0 | | |
| | *At an altitude of 230 ft. above sea level.* | | |
| 0.98 | 24 | during the first 5 years. . 2.62 ft. | from 0 to 5 years. . 13.12 ft. |
| 14.10 | 19 | » the next 5 » . . 2.62 » | » 5 » 10 » . . 13.12 » |
| 27.22 | 14 | » » 4 » . . 3.28 » | » 10 » 15 » . . 17.48 » |
| 40.34 | 10 | » » 3 » . . 4.36 » | » 15 » 20. » . . 18.56 » |
| 53.46 | 7 | » » 4 » . . 3.28 » | » 20 » 24 » . . 10.50 » |
| 73.80 | 3 | » » 3 » . . 2.39 » | |

TABLE III. — *Volumes and form factor of black poplars at different ages and quinquennial percentage of increment.*

| Volumes and form factor | | | Quinquennial percentage of increment | |
|---|---|---|---|---|
| | | *At an altitude of 2460 feet.* | | |
| | Vol. cub ft. | Form factor | | Increment per cent |
| | — | — | | — |
| In the first year | 0.000 67 | — | from 0 to 5 years | — |
| » 5th » | 0.028 18 | 0,33 | » 5 » 10 » | 61,11 |
| » 10th » | 0.423 07 | 0,36 | » 10 » 15 » | 35,36 |
| » 15th » | 1.917 17 | 0,36 | » 15 » 20 » | 25,22 |
| » 20th » | 5 788 66 | 0,40 | » 20 » 25 » | 12,11 |
| » 25th » | 10.666 66 | 0,40 | | |
| | | *At an altitude of 230 feet.* | | |
| In the first year | 0,001 45 | — | from 0 to 5 years | — |
| » 5th » | 0.185 79 | 0,33 | » 5 » 10 » | 56,23 |
| » 10th » | 1.723 12 | 0,36 | » 10 » 15 » | 29,60 |
| » 15th » | 6.310 37 | 0,39 | » 15 » 20 » | 22,19 |
| » 20th » | 29.876 36 | 0,40 | » 20 » 24 » | 10,13 |
| » 24th » | 31.748 61 | 0,39 | | |

From his investigations and from the comparison of the results obtained at various altitudes the writer draws the following conclusions:

The yearly increments both in height and in girth vary according to the various conditions of climate. They are more rapid and more considerable under mild climates where the period of vegetation is longer and they diminish as the climate gets colder. Thus black poplars in the plain of Prato (province of Florence, Tuscany) at an altitude of 230 ft. had a yearly average increment of 36.9 inches in height and 0.55 in. in diameter, while the same trees at about 1500 ft. above sea level showed a yearly average increment in height of 28.9 inches and 0.45 inches in diameter at the base. At the same time the corresponding figures for trees at 2460 feet altitude were respectively 26.9 inches and 0.37 in. These data are calculated for trees 24 years old.

Thus for the region under consideration the following data have been obtained:

TABLE IV. — *Dimensions of black poplars 24 years old at various altitudes in the Tuscan Appennine.*

| At an altitude of | Height | Diameter | Vo ume |
|---|---|---|---|
| 2 460 feet | 53.8 feet | 8.85 inches | 10.327 cub. ft. |
| 1 500 » | 58.4 » | 10.84 » | 21.475 » |
| 230 » | 73.8 » | 13.03 » | 31.749 » |

It is to be noted that the form of trees depends more upon the conditions of growth and especially upon the distance between them than upon the climate.

In the first case (altitude 2460 feet) and in the third (altitude 230 feet) the writer examined plants cultivated in rows along torrents and situated at a fair distance from each other (about 13.12 feet), and found that the form taken by the tree is on the whole intermediate between a cone and a paraboloid of Apollonius, though nearer to the former solid ; while in the second case (altitude about 1500 feet) in which he examined trees planted in a grove at an average distance of 9 feet apart, the form is conical with a strong tendency, especially towards the top to assume that of the nelloid.

Lastly the writer gives the data which he has collected upon the successive and final yield, as well as upon their utilization in order to ascertain the effective returns of these treese at various altitudes.

On account of their short life no thinnings are practised with poplars and the only intermediate product is that afforded by removing the small branches from the stem, which is usually done every three years. These are made into faggots which, sun dried, weigh about 5.5 lbs. each; in this weight the branches and twigs contribute 4 lbs. and the leaves the remaining 1,5 lbs. The latter are fed to the sheep in winter. The writer states that every three years the trees between 1300 and 1600 feet above sea level yield :

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| At the age of: | 5 | 10 | 15 | 20 | 25 | 30 | 35 years |
| number of faggots: | 1 | 3 | 6 | 9 | 12 | 12 | 13. |

The above figures increase slightly for the trees situated in the plain and diminish for those on the higher levels.

The final product is for the most part used for carpentry, the rest, consisting of tops, waste wood obtained on squaring the timbers and shaky wood, as fuel.

In the three cases examined the following results were obtained:

TABLE V. — *Timber and firewood yielded by black poplars at various altitudes.*

| Altitude, feet | Age of tree years | Total velume of trunk cub. feet | Waste-wood | |
|---|---|---|---|---|
| | | | Total, cub. feet | Percentage of total volume |
| 2 460 | 26 | 13.479 | 1.686 | 12.50 |
| 1 500 | 35 | 57.486 | 6.946 | 12.08 |
| 230 | 24 | 31.749 | 3.289 | 10.15 |

Thus the average percentage of wood lost on the final product ranges between 10 and 12.5 per cent., whilst there is very little difference between the volumes of the terminal conoids in the three cases examined. The

quantity of wood removed by squaring is proportional to the age and development of the tree. Thus in the case of small volumes the loss is 4.53 per cent.; with medium volumes it is 5.02 per cent.; and for greater ones it reaches 7.61 per cent and more. The loss for defects (cuppy or shaky wood) follows nearly the same law.

One cubic foot of well seasoned poplar weighs on average about 40 lbs. and one cubic foot of well dried branches without leaves, weighs about 28 lbs.

## LIVE STOCK AND BREEDING.

HYGIENE

71 – **Researches on the Causal Agent of Epizootic Lymphangitis.** — BOQUET, A. and NÈGRE, L. (Institut Pasteur d'Algérie) in *Bulletin de la Société de Pathologie Exotique*, Vol. VII, No. 6, pp. 464-466, 1 fig., 1914, Vol. VIII, No. 2, pp. 49-52, 1 fig. and No. 5, pp. 248-250. Paris, 1915.

Doubt has been expressed as to the yeast-like nature of the causal organism of epizootic lymphangitis in the horse and certain authors have endeavoured to identify the Cryptococcus of Rivolta with one of the Protozoa. In the above papers, the writers, by means of cultures in artificial media bring additional evidence to demonstrate the mycotic nature of the parasite.

Attempts at artificial inoculation with the organism so obtained have not been successful in producing the characteristic lesions of epizootic lymphangitis but the writers consider the following conclusions may be drawn:

The cryptococcus develops in an artificial medium in the form of round cells and mycelial filaments with chlamydospores. In natural conditions of infection it is probable that the yeast forms budded off from the round cells obtain access to the superficial lymphatic circulation through the agency of a wound giving rise to the specific lesions of epizootic lymphangitis. The causal agent of this malady would thus be a saprophytic fungus occuring in the external medium, in the same way as the agents of other mycotic infections. It would only show its pathogenic properties in certain conditions which have not yet been definitely ascertained.

72 – **Dourine and the Complement Fixation Test.** — WATSON, E. A. (Pathologist, Veterinary Research Laboratory, Lethbridge, Canada) in *Parasitology*, Vol. 8, No. 2. pp. 156-183. London, September, 1915.

The object of the present paper is to draw further attention to the value of the complement fixation reaction as a diagnostic test in dourine and to recommend a method of procedure and technique arrived at with an experience of 15 000 tests for dourine made at the Veterinary Research Laboratory, Lethbridge, Canada.

A detailed account is given of the manner of preparation of the reagents — red cells, haemolytic serum, complement, antigen and antibody — and their titration, the collection and inactivation of serum etc.

In conclusion, absolute confidence is expressed in the complement fixation test for dourine as presented in the paper, the claim being made that apparent failures or discrepancies are due, not to the method itself but to faulty technique on the part of the operators. Among other points it is maintained that the test is as capable of practical application as that of mallein or tuberculin. The action by the method recommended is specific, nor is the technique more intricate or laborious than many other necessary and accepted laboratory methods.

73 - **Experiments on the Immunisation of Horses against Glanders.** — PFEILER, W., in *Berliner Tierärztliche Wochenschrift* Year 31, No. 45, pp. 532-533. Berlin, November 11, 1915.

The object of the writer was to obtain experimental evidence as to the possibility of rendering horses immune to glanders, thereby disproving the majority of German veterinary practicians. Of the six animals (horses and donkeys) employed, two were inoculated as controls with cultures of the specific bacillus (1/2400 Oese). Both contracted the disease. The remaining four animals were first rendered immune by means of a special vaccin and subsequently injected with the same amount of the culture as had been introduced into the control animals. In no case was the disease produced. The same negative result was obtained on injecting the same four horses with an amount of the culture 2, 4, or 8 times stronger than that used in the first experiment.

The writer concludes that it will be possible to confer immunity against glanders and intends to continue his experiments.

74 - **Studies on Piroplasmic Infection in Horses.** — CARPANO, MATTEO (Military Veterinary Bacteriological Institute, Rome) in *Il Moderno Zooiatro*, Series V, Year IV, No. 10, pp. 404-412, figs. 2. Bologna, October, 31, 1915.

The writer gives a general account of piroplasmosis and malaria in horses in Italy with particular reference to his own laboratory and clinical observations.

*Etiology:* Equine piroplasmosis in Italy is caused by two distinct haemo-parasites: *Nuttalia equi* and *Babesia caballi* which give rise to two pathological states: *nuttalliosis* and *babesiosis* showing somewhat different clinical forms and pathological lesions. Nuttaliosis is generally the more serious and more frequent form.

Occasionally both parasites are found in the some animal simultaneously. The virulence of these parasites varies according to the latitude, being greater in more southern latitudes.

Piroplasmosis has been recorded in almost all regions of Italy, though the disease is only known to be enzootic in certain regions of low altitude where stagnant water easily accumulates on rough unimproved land, where ticks are abundant, and where horses are reared in partial or complete freedom.

It would be better to regard piroplasmosis as a disease of uncultivated countries rather than as a tropical disease.

*Transmission.* The two species of Ixodes transmitting this disease in Italy

are: *Rhipicephalus bursa* carrying *Nuttalia equi* and *Margaropus annulatus* carring *Babesia caballi*. The former ectoparasite completes its life history on two horses as hosts; on one it passes the larval and nymphal stages and on the other the adult stage up to the egg-laying period. In this way the infection from the first horse is carried to the second. *Margaropus annulatus* on the other hand completes its life cycle on the same host. In this case the disease is transmitted by the young insects reared on diseased animals, and in order to infect a fresh animal the following year the haemosporidium must be contained in the egg of the tick.

Transference of the disease may be obtained artificially by the inoculation of infected blood on condition that the animal inoculated is very receptive.

*Primitive and relapsing injection.* — The first symptoms of the attack of the parasite appear chiefly during the long period of grazing in the spring and summer. The relapsing symptoms may be observed at all times of the year and also in animals indoors. The primitive piroplasmic infection begins in 10 to 12 days after arrival of the animal in the infected zone containing infected ticks. The relapsing fever may be detected a short interval after the primary infection or after a considerable period, sometimes even years after. The longer the interval the less serious the disease. It appears that nuttalliosis is only relapsing in nature.

The writer accounts for the origin of the relapsing fever in the following manner. Horses clinically cured of piroplasmosis continue to harbour the specific sporozoa for a considerable time after. These latter however, gradually lose their morphological identity and acquire an anaplasmatic appearance in which form the writer has observed them in the circulation. These latent or " resistant " forms are capable of infecting fresh ticks which give rise to relapsing infections. The writer has also obtained them in laboratory cultures from *Nuttalia equi*. The causes predisposing to relapsing fever are, other than overwork, the occurrence of other infections and, chiefly in Italy, adenitic and typhoid fevers.

According to the writer the disease known in Italy as " balordone addominale " is due to a mixed infection of streptococci and *Nuttalia*.

*Immusisatiom.* — The disease naturally or artificially contracted by inoculation of infected blood confers a certain immunity which, however, is not absolute. Immunity is acquired generally during the first years of life, following repeated primary and relapsing attacks, but it is not certain that heredity does not influence the susceptibility. Immunity is known amongst horses living in badly infested zones.

Primary infection also exists in a benign form often merely causing a slight rise of temperature for 2 or 3 days. The resistance of these horses increases with the age of the animals.

Acquired immunity following the disease or by inoculation of infected blood is strictly specific for the particular organism.

In Italy there is also a piroplasmosis of mules and asses which appears to be carried only by *Nuttalia*. Infection is also rare and mostly benign in character at least for quadrupeds living in regions where the piroplasmosis is enzootic.

75 - **Studies on Bovine Piroplasmosis in Algeria.** — SERGENT, EDM., L'HÉRITIER, A., BOQUET, A. and BEGUET, M. (Institut Pasteur d'Algérie) in *Bulletin de la Société de Pathologie exotique*. Vol. VI, N° 8, pp. 573-574; N° 9, pp. 618-623; Vol. VII, N° 10, pp. 699-700. Paris 1913 and 1914.

*Treatment of piroplasmosis by means of trypan-blue.* — The injection of trypan blue, in the course of actual practice of the treatment of bovine piroplasmosis in Algeria, has proved useful in benign cases or in cases of moderate gravity, but in severe cases it has been inefficacious. These last are probably due to poisoning by the toxic products of the piroplasms; the bacilli themselves having disappeared from the circulation, the reagent would be without effect. Three years experience has shown the following technique to be most useful:

(1) Treatment to be carried out as early as possible.

(2) Doses = 1 gr. of trypan-blue per 100 kgs. live weight of animal, in a 1 per cent. solution with distilled lukewarm water to be made up at the time of injection.

(3) The solution to be raised to the body temperature of the animal and injected intravenously at a slow rate.

(4) In certain cases the injection to be repeated once or twice within a brief period, say two days.

*Infection of imported animals.* — Dairy cattle imported into Algeria from Europe often become infected with piroplasmosis very shortly after their arrival. The writers, who have observed and tabulated such cases, draw the following coonclusions:

Piroplasmosis, common in Algeria, during the hot season, may also occur in winter.

The period which elapses before infection is manifested in an imported cow may be as short as 11 days, even in winter.

*Occurrence of* Anaplasma marginale *in Algerian bullocks.* — SERGENT and BEGUET have recorded, for the first time, the occurrence in Algerian bullocks of *Anaplasma marginale*, causing symptoms similar to those of piroplasmosis as it occurs in the Departments of Algiers and Oran.

*Piroplasmic infection without morbid symptoms.* — SERGENT and HÉRITIER also record cases in cows imported from France of intense piroplasmic infection, characterised by a complete lack of any morbid symptoms.

76 - **A Disease in Cows Due to the "Flesh Fly", *Sarcophaga magnifica*.** — LUTJE, in *Deutsche Tierärztliche Wochenschrift*, Year 23, No. 46, pp. 395-397. Hanover, November 13, 1915.

The evidence of the presence of this parasite is an inflammation of the mucous membrane of the vagina. The inflammation is very marked, especially beneath the clitoris, and results after a few days, in local mortification of the tissue. Later, the lower portion of the vagina becomes filled with coagulated blood from the inflamed portion and also decomposed cells. The affected tissue is found to harbour the larvae of a fly, These are light yellow in colour, 10 to 15 mms long and 3 to 4 mms in diameter blunted at one extremity and with the other terminating in a point and provided with a boring process. The cavities in which the larvae occur are surrounded by thick tissue and communicate with the groove of the clitoris. The disease

is easily cured by removing the larvae from the vagina and treating the wound with iodine. As a rule the cure is complete at the end of some days.

For the purpose of closer study the writer made experiments in rearing the larvae from the vagina of diseased cows. The larvae were placed in glass vessels and fed on the diseased tissue from the infected vagina. After a few days, they underwent their metamorphosis into dark brown pupae from 15 to 20 mms. long and were then identified as belonging to the species *Sarcophaga magnifica* described by the writer. The fly is viviparous, and deposits its larvae on the healthy mucous membrane, these latter then bore their way into the tissue. The fly only attacks cows and heifers at pasture and may then infest whole herds.

77 - **Vaccination of Sheep against the Disease *Septicaemia pluriformis ovium*.** — RAEBIGER, H. and SPIEGL, A., in *Deutsche Tierärztliche Wochenschrift*, Year 23, No. 47, pp. 406-409. Hanover, November 20, 1915.

In their experiments with the vaccination of sheep, begun in 1912, against *Septicaemia pluriformis ovium*, the writers have employed a serum which they prepared by means of inoculating 3 sheep with virulent strains of *Bacillus ovisepticus*. For the purpose of trial, white mice suffering from the disease were injected with 0.2 and 0.3 cc. of the serum. The treated mice survived while those that remained unvaccinated, invariably succumbed. The serum was thus positive in action.

The veterinary practicians who forwarded their reports to the writers had vaccinated 3 230 sheep (13 flocks) of which 2 804 were healthy, 250 diseased, and 176 doubtful ; 867 animals were left unvaccinated as controls. The observations made may be summarised as follows :

Previous to vaccination, in 11 flocks (no report was sent in for 2 flocks) the mortality was 9 per cent. After vaccination, among 3230 animals, the mortality was 3.7 per cent or a reduction of 5.3 per cent. There were, however, among these sheep previous to vaccination 250 diseased animals of which 138 were slightly, and 112 severely attacked. The percentage diseased was thus 7.7 per cent or almost equal to the percentage of mortality. Of these 250 animals 50 per cent. died after vaccination. In other words, 250 representing 7.7 per cent of the total, the number of sheep saved by vaccination was 3.8 per cent. Had these 7.7 per cent not been vaccinated the percentage mortality would have been $9 + 7.7 = 16$ per cent. By means of vaccination the lives of $5.3 + 3.8 = 9.1$ per cent were saved. The mortality was thus reduced by 50 per cent.

78 - **The Life History of *Nematodirus filicollis* Rud., a Nematode Parasite of the Sheep's Intestine.** — BOULENGER, C. L. (Reader in Helminthology, University of Birmingham) in *Parasitology*, Vol. VIII, No. 2, pp. 133-153, 5 figs., 2 plates. London, September 1915.

The eggs of *Nematodirus filicollis* when laid contain an embryo with 7 or 8 cells, they pass out of the host with the faeces. Development takes place slowly and the embryos are not ready to hatch until 24 to 28 days have elapsed. In their early stages the embryos are not able to withstand desiccation and are killed if frozen or subjected to high temperatures.

Whilst still within the egg-shell the embryo undergoes two ecdyses and when ready to hatch is enclosed in a tightly fitting sheath formed by the ncompletely cast skin of the second moult. The sheathed larvae are often retained for a long time within the egg-shells and both in this position and after hatching can resist complete desiccation for considerable periods (twenty months or longer) ; when dried they are able to withstand freezing as well as temperatures much above those likely to be met with in the open.

The free larvae will live for a considerable time in water, they possess well-developed migratory instincts and climb vertical surfaces such as grass stems and blades. The sheaths are cast off by the larvae when these are subjected to temperatures approximating to the blood temperature of the host.

No infection experiments were made on sheep, but other evidence shows that these animals must become infected by swallowing the sheathed larvae, either when free or whilst still enclosed in the egg-shells.

79 – **Sheep Lice.** — *The Pastoral Review*, Vol XXV, No. 9, pp. 854-855, figs. Melbourne, September 16, 1915.

Sheep lice belong to the following species : *Haematopinus ovilus, H. macrocephalus* (= *H. pedatis* found in the United States), *Trichodectes sphaerocephalus*. The first was discovered in New Zealand in 1906 ; the second was reported for the first time (in Australasia), in the South Island, New Zealand. As insecticidal sheep dips have been used for a long time in New Zealand, these insects have not caused much injury. These two species suck blood from their host which they weaken and cause to produce less wool. The third species is more injurious, it does not suck but feeds on the epidermis and on the wool. It is so prolific that in a short time one ram bearing lice will infect a whole flock.

On account of the drought during 1915, the Australian shepherds were compelled to graze their flocks even in the lice infected districts and to mix immune with infected flocks ; this caused a rapid spread of the parasite.

Mr F. H. Williams, chief zootechnical inspector for South Australia estimated that in that State the loss of wool due to lice amounted to £100 000 in 1914 and to a much greater sum in 1915, in which year the parasite was found over a much larger area than in preceding years.

The ova of the lice, being surrounded by a fatty matter, are not wetted by insecticides, hence the necessity of two dips : one after shearing and the other within sixty days, that is, before the lice hatched from the ova which survived the first dip should begin their oviposition. Mr Williams considers the dips containing poisonous substances as the only useful ones to protect sheep against infection.

80 – **Symptomatic Anthrax in Swine.** — Sanfelice, Francesco (Institute of Hygiene of the University of Modena) in *Il Moderno Zooiatro*, Series V, Year IV, No. 10, pp. 397-403 Bologna, October 31, 1915.

Workers on the disease known as symptomatic anthrax state that cattle are most subject to this disease when they are between 4 months and 5 years old; during the first months of their life and after 5 years of age they

are practically immune. Further, that sheep and goats are rarely attacked, donkeys and horses develop a painful swelling at the spot inoculated and suffer considerable pain; rabbits, guinea-pigs, mice, rats, dogs, cats and swine are immune. Special experiments have also shown that symptomatic anthrax does not always take the same form in cattle. It is also known that members of the Equidae are subject to attack by different strains of the bacillus of symptomatic anthrax. As regards pigs the views expressed above have been contradicted by a certain number of experiments and observations (MAERK, WILLENBERG, RATZ) which tend to show that pigs may be subject to the disease.

In January 1915, the writer actually observed such a case in a pig. He isolated from the infected muscles an anaerobic micro-organism and prepared a culture which showed all the morphological and cultural characters of the bacillus producing symptomatic anthrax. An emulsion of a physiological solution of the dried muscles, when inoculated into a pig a few month old, induced the disease which proved fatal after 14 hours. Guinea pigs and rabbits were also inoculated both with the muscular fluid and with cultures on agar; the results were fatal in the first case and negative in the second. Puppies which ate the flesh of pigs that had died of symptomatic anthrax experienced no ill effects. Hedgehogs inoculated subcutaneously with infected matter died after two days. Pure cultures of the inoculated microorganism were obtained alike, from young pigs, guinea-pigs and hedgehogs. The anaerobic micro-organism isolated from pigs was pathogenic even for pigeons.

An attempt was then made on the part of the author to ascertain whether the bacilli of symptomatic anthrax in swine are identical with those causing cattle anthrax, or belong to closely related strains.

For purposes of comparison cultures were made of micro-organisms isolated from the flesh of a cow that had died of symptomatic anthrax. A pig inoculated with fluid from the muscles of this cow, failed to contract the disease; 10 days later, it was inoculated with a physiological solution of the muscles of a pig that had died from symptomatic anthrax, but without any effect. Any possibility that the virulence of the micro-organisms in dried flesh was attenuated can be excluded. The first inoculation thus had the effect of immunising the animal against the second. It follows from this that the bacilli of symptomatic anthrax in swine do not belong to the same strain as those producing the cattle form of the disease, but to one nearly related. That it is a question of closely related strains and not of different species is shown both from the results of the inoculations, and from the serological reactions. The infected matter or the pure cultures taken from the muscles of cattle, inoculated into the animals usually employed as the subjects of the experiments (guinea-pigs, hedgehogs, pigeons) gave results identical with those obtained in the case of the disease in pigs. The only difference between the bacilli of the cattle form of the disease and those of the disease in swine is, that while the latter are fatal to pigs, the former have no pathogenic effect upon these animals.

81 – **The Character of the Water-Soluble Nitrogen of Some Common Feedingstuffs.** — HART, E. B., and BENTLEY, W. H. (University of Wisconsin) in *The Journal of Biological Chemistry*, Vol. XXII, No. 3, pp. 477 to 483, 1 Table. Baltimore, Md., October 1915.

The methods commonly employed for the estimation of " amide " nitrogen are not such as to give a perfect picture of the nitrogen distribution in such materials. It is certain, for instance, from experimental evidence that copper hydroxide Cu $(OH)_2$ does not make a complete precipitation of all protein and polypeptide structures and thereby give a clean quantitative separation of amide nitrogen from protein nitrogen. It is also evident that the so-called " amide " nitrogen or what is not precipitated by the copper hydrate, is a mixture of acid-amide nitrogen, amino-acid nitrogen and ammonia nitrogen. Whereas it is certain that amino-acid nitrogen has direct nutritive value it is not so certain that ammonia nitrogen or acid amide nitrogen have any value in normal protein storage.

It is considered that the differentiation of forms of nitrogen in feeding stuffs by a method which makes no attempt at differentiation on the basis of nutritive value should be discontinued. The present paper is merely concerned with a discussion of the water soluble nitrogen of some feeding materials for the purpose of securing a clearer picture of the composition of the so-called "amide" nitrogen.

The following plant materials were analysed at different stages of growth: Alfalfa, red clover, sweet clover, rape, maize, peas, oats, barley, June grass, timothy, sugar beet, cabbage. A summary of the results is appended.

1) The " amide " nitrogen of feedingstuffs is largely composed of free amino-acids and peptide linkings. In most cases the nitrogen in these structures constitutes 50 to 70 per cent of the water-soluble nitrogen.

2) The quantity of acid-amide nitrogen is relatively small, seldom exceeding 20 per cent of the water-soluble nitrogen, and more often being below 10 per cent. Maize stover (maize hay without the cobs) is an interesting exception showing approximately 40 per cent of the water-soluble nitrogen in acid-amide form.

3) The ammonia nitrogen rarely exceeded 5 per cent of the total water-soluble nitrogen and in some instances was wholly absent.

82 – **Gossypol, the Toxic Substance in Cotton Seed Meal.** — WITHERS, W. A. and CARRUTH, F. A. (North Carolina Agricultural Experiment Station) in *Journal of Agricultural Research*, Vol. V, No. 7, pp. 261-288, 2 plates. Washington, D. C., November 15, 1915.

This substance was first isolated by Marchlewski from cottonseed oil and considered as a prospective dye stuff. It has been extracted by the writers from cottonseed kernels and found to possess toxic properties.

The kernels were first treated with gasoline to remove most of the oil and then exctracted with ethyl ether. From the crude product obtained by the evaporation of the ether extract " precipitated gossypol " was obtained by the addition of gasoline and a crystalline product, " gossypol acetate ", by precipitation with acetic acid.

Both the extract and the acetate were fatal to rabbits when administered intraperitoneally in a single large dose or in small daily doses.

The smallest amount that proved fatal was 0.24 gram of crystalline gossypol acetate per kilo of live weight.

When oxidised gossypol becomes non-toxic. It is also rendered non-toxic by treatment with iron salts which may stimulate the oxidation process or form insoluble compounds.

Cotton-seed meal may be rendered non-toxic by 1) treatment with ether or ether and alcohol; 2) treatment with alcoholic solutions of alkali (causing oxidation); and 3) treatment with iron salts.

The tissue surrounding the cells of the gossypol glands probably prevents the free action of the reagents. This constitutes the principal difficulty to be overcome by the miller and stock feeder in rendering cotton-seed meal non-toxic.

CATTLE

83 – **Experiments in Feeding Milch Cows with Potatoes from Silo.** — VÖLTZ, W., JANTZON, H. and DIETRICH, W. in *Landwirtschaftliche Jahrbücher*, Vol. 48, No. 4, pp. 493-569. Berlin, October 26, 1915.

In Germany, potatoes are usually stored according to two methods which give very different results. The first, or ordinary method, consists in preserving the potatoes in silos without the addition of special ferments. This system has the disadvantage of not always supplying a good feed, on account of the bad fermentations that may be produced in the silos. On the other hand, the second method owing to the pure ferments which in this case are added to the potatoes in the silos generally yields a feed of good quality.

The writers made 11 comparative experiments, using in every case from 100 to 300 cwt. of potatoes either raw or boiled with a view to determining scientifically the practical value of the two methods. In one experiment the potatoes were raised to a temperature of 140° F. in order to convert their starch into paste. In each case the raw potatoes were either crushed or cut into slices. To the raw potatoes were added pure culture of *Bacillus cucumeris fermentati* Henneberg and to the boiled potatoes, *Bacillus Delbrucki*. The ,maximum development of the first ferment occurs between 59° F and 86° F and that of the second between 104° and 113° F.

The experiments admitted of the following statements being made:

The ordinary method of preserving potatoes does not give consistently good results. Unless the silo is hermetically closed, butyric fermentation takes place and the ensilage becomes useless. The same effect is observed in the case of boiled potatoes.

To obtain a good feed, pure ferments should be added to the potatoes in the silo. Ensilage should be made in autumn, or spring, but never in summer . Raw potatoes preserved with pure ferments lose from 5 to 10 per cent of their nutritive substances, as do also potatoes heated to 140° F. Raw potatoes to which chaff or chopped straw, (2 to 3 per cent) are added do not lose more nutritive substances than those preserved without such addition. In this latter case, however the temperature of the silo must be favourable to good lactic fermentation (77° to 86° F.).

Boiled potatoes preserved with pure cultures only lose 5 pr cent of their content of nutritive substances. They can be fed to all animals and

make a better feed than raw potatoes. The writers recommend that only boiled potatoes should be stored as ensilage. However raw potatoes can be used where it is necessary to store large quantities in a short time, or where it is impossible to boil all the tubers.

In the second series of experiments carried out with milch cows, the object of the writers was to determine the nutritive value of ensilaged potatoes. The following results were obtained:

1) Boiled potatoes, when not stored in silos, only increased the milk yield to a very slight extent.

2) Raw ensilaged potatoes slightly increased the milk yield.

3) Boiled, ensilaged potatoes markedly increased the supply of milk.

4) The largest increase in the milk yield was obtained by feeding potatoes in the raw untreated state.

5) The effect of all four kinds of potatoes upon the fatty matter and dry matter of the milk was identical.

6) The maximum amounts of protein and of nitrogen-free extract were furnished by raw, unstored potatoes; next in order were the boiled ensilaged potatoes and finally came the unstored boiled potatoes. From these results it is clear that for the production of milk intended for direct consumption, or for cheese-making, unstored raw potatoes should be fed. If the milk is paid for according to its fat content raw potatoes, either treated or untreated, should be given, or else boiled potatoes after treatment in the silo.

84 – **Sesame Cake as a Feed for Milch Cows.** — GIULIANI, R. in *R. Scuola Superiore di Agricultura in Milano, Annuario della Istituzione Agraria Dott. Andrea Ponti*, Vol. XII, Rural Years 1913-1914, pp. 1-69. Milan, 1915.

These experiments were conducted according to Kellners' method to determine the effect of sesame cake on *a*) the health and live weight of cows; *b*) the quantity and quality of the milk; *c*) the character of the cheese; *d*) the cream yield of butter and its quality. The control ration consisted of grass, hay and 3.3 lbs of linseed cake. The conclusions drawn from the experiments are as follows:

Sesame cake is a palatable and healthy food for cows; in the quantity administered in the experiments it had appreciable effect on the live weight. It has a favourable influence on the quantity of milk, increasing the amount from 1.35 to 4.50 per cent. The greatest increase in milk yield was obtained with 3.3 to 4.4 lbs of sesame cake per head per day and the lowest increase was obtained with 5.5 lbs. The dry matter was reduced in amount by 0.19 to 0.42 per cent and the fat content by 0.22 to 0.63 per cent; the minimum decreases being obtained with 5.5 lbs of cake.

No appreciable change was observed in the percentages of nitrogen, lactose and mineral matter of the milk due to feeding sesame cake. It also had no appreciable effect on the acidity and coagulability of the milk, nor on the qualities of the cheese. Its effect on the butter was merely to make the colour less yellow and to give it a more delicate flavour; the time required for churning was the same, but the yield of

butter was from 0.11 to 0.34 per cent lower, the lowest decrease being obtained with 3.3 to 4 lbs of sesame cake and the maximum decrease with 5.5 lbs of cake per head per day. When fed in larger quantities than 3.3 lbs per head per day the melting point of the butter was lowered from 1° to 2° C., thus making it softer. Increasing quantities of sesame or of linseed cake produced corresponding decreases in the REICHERT-MEISSL number and corresponding increases in the index of refraction, the HEHNER number and the iodine index. The butter from cows receiving sesame cake never gives the AUDOIN reaction.

With regard to its effect on the quantity and quality of the milk sesame cake may be considered economically more useful than linseed cake when fed at the rate of 3.3 to 4.4 lbs per head per day; at the rate of 5.5 or more the contrary is true. If quantity only is taken into consideration sesame cake is always more useful.

To sum up, sesame cake is a good concentrated feed for milch cows. In order to obtain the best results it should not be administered in greater quantity than 4.4 lbs per head daily.

85 – **The Effect of Feeding on the Composition of Milk and Butter: Linseed Cake and Hempseed Cake.** — CRANFIELD, H. T. and TAYLOR, MARGARET G. D. (Midland Agricultural and Dairy College, England) in *The Analyst*, Vol. XL, No. 475, pp. 433-439, 2 figs., October, 1915.

Hemp seed cake — a feeding stuff rarely met with on English farms previous to the war — is somewhat similar in appearance and general characteristics to linseed cake. Its only apparent drawback is its poor keeping quality, especially in summer. The two cakes used in this experiment gave the following analyses.

| | Linseed Cake | Hempseed Cake |
|---|---|---|
| Moisture | 13,85 | 11,47 |
| Oil | 8.98 | 7.87 |
| Albuminoids | 27,39 | 28,87 |
| Soluble carbohydrates | 33,26 | 23,85 |
| Fibre | 10.42 | 21.07 |
| Ash | 6,10 | 6.87 |
| | 100.00 | 100.00 |
| Total food units | 124.20 | 115.7 |

Two sets of cows, crossbred Shorthorns, were selected, four in each set. The conclusions derived from the experiment were that the composition and quality of milk and butter produced by feeding hemp-seed cake is quite equal to that obtained by feeding linseed cake.

86 – **Experiments on Feeding Cows and Calves with *Andropogon sorghum*.** — See above No. 42.

SHEEP

87 – **Experiments in Germany on Feeding Lambs with Pine Needles.** — STUTZER, A. and HAUPT, W. in *Landwirtschaftliche Jahrbücher*, Vol. 48, No. 4, pp. 571-585. Berlin, October, 26, 1915.

This experiment included 5 periods, each lasting from 8 to 12 days. The 3 lambs that were the subjects of the experiment received daily in

addition to their basal ration, from 150 to 250 gms. of pine needles per head. Although the needles were fed in a finely divided state the lambs showed no appetite for them. When mixed with hay and potato meal 24 per cent of the organic matter was digested. After the needles had been treated with alcohol in order to remove any injurious or disagreable substances, the lambs utilised 35 per cent of the organic matter; the effect of the treatment was to render soluble the cellulose and nitrogen free extract. The following table gives the relative digestibility compared with hay :

| | Hay Per cent — | Pine needles Per cent — |
|---|---|---|
| Organic matter | 56.0 | 24.3 |
| Crude protein | 50.5 | — 14.9 |
| Crude cellulose | 52.3 | 25.7 |
| Nitrogen-free extract | 59.3 | 17.8 |

Not only was the protein of the pine needles indigestible, but it also decreased the digestibility of the albuminoids of the basal ration, an effect possibly due to tannic substances which render the protein insoluble.

Treating the needles with alcohol increased the digestibility of the protein from — 14 per cent to — 5 per cent. In the case of pine needles that had fallen from the trees of their own accord, the protein was much less digestible than in that of the green needles.

The writer concludes from his experiments that pine needles are very difficult to digest, because their cells contain specific substances which hinder the destructive action of the ferments and the bacteria present in the stomach of animals. Consequently these leaves cannot be used as forage.

88 – **Pig-feeding Experiments With Aftermath Hay Meal.** — Billwiller in *Schweizerische Landwirtschaftliche Zeitschrift*, Year XLIII, Part 39, pp. 911-915. Zurich, September 24, 1915. PIGS

In this experiment with meal prepared from aftermath hay 4 lots of pigs were used and for 36 days received the following rations :

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Lot 1. | 6.6 lbs. | aftermath hay meal | 19.8 lbs | maize and | 2.6 lbs. | fish meal | | |
| » 2. | 8.8 lbs. | » » » | 17.6 » | » » | 2.6 lbs. | » » | | |
| » 3. | 13.2 lbs. | » » » | 13.2 » | » » | 2.6 lbs. | » » | | |
| » 4. | no aftermath hay meal | | 25.4 » | » » | 2.6 lbs. | » » | | |

The last lot received in addition, as a supplementary ration, about 2.2 lbs. of sugar beet per head daily. The food was given in a dry state by means of an automatic distributor.

The results of the experiment showed that, given the high prices of concentrated foods, it pays well to feed pigs on aftermath hay meal, as, notwithstanding the fact that the increase in live weight was largest in lot 4, the price per lb. of live weight was notably higher in this lot than in those which received hay meal.

89 - **Feeding Experiments on Young Pigs with Skim Milk Supplemented by Cream Substitutes of Varying Protein Content** (1). — WELLMAN, OSCAR (Zootechnical Institute of The Royal Veterinary School of Budapest) in *Kisérletügyi Közlemények*, Vol. XVII, Part 2, pp. 397-469, 21 tables (German summary pp. 472-475). Budapest, 1915.

For the purpose of experiments on metabolism 8 young pigs of Berkshire breed were employed. The animals, which weighed from 11 to 40 lbs. with ages ranging from 4 to 12 weeks, were fed the following substances: " diafarinised milk " (skim milk to which flour starch saccharified by a preparation of diastase had been added); emulsion milk (2) (skim milk emulsified with a cheap substitute for milk fat); diafarinised milk with the addition of water. The nutritive ratios were: narrow (1 : 2.5); fairly narrow (1 : 4.5); fairly wide (1 : 5.8); wide (1 : 7.8).

The individual experiments lasted from 23 to 39 days and the whole period covered was 262 days. In each case two or three animals belonging to the same litter were fed skim milk to which carbohydrates or fat had been added. The results of the experiments may be summarised as follows:

1) The animals usually consumed larger quantities of " diafarinised " milk (which was fed *ad lib.*), than of emulsion milk. The differences in the nutritive ratios did not have much effect upon the amount of food ingested, except that in some cases the milk with the wide nutritive ratio caused digestive troubles.

2) The milk with the fairly wide (1 : 5.8) and the wide (1 : 7.8) ratios caused diarrhoea. With the emulsion milk this trouble was only of a mild character as the symptoms always disappeared when the animals were dosed with a solution of citric acid. The diafarinised milk caused digestive troubles of a more serious character, so much so that the experiment with the fairly wide nutritive ratio could only be concluded with difficulty and that with the wide ratio was left uncompleted.

3) The milk rich in carbohydrates acted unfavourably on the digestibility of the ash and the protein. In both cases the wide ratio had an adverse effect upon the digestibility of the protein.

4) The amount of protein ingested daily in each case was from 3.7 to 8.7 kg. per 1000 kg. live weight, that is to say the amount of protein ingested was not only equal to the standard recommended by KELLNER but in one case it even exceeded it by 40.3 % and in another case it fell short of KELLNER'S figure by a similar amount. The young pigs ingested each day per 1000 kg. live weight: with emulsion milk, a maximum of 13.7 kg. of digestible fat; with the diafarinised milk 36.8 kg. of digestible carbohydrates. The quantity of dry matter ingested varied from 18.3 to 43.7 kg.; that of starch equivalent from 25.6 to 40.9 kg.; the consumption of energy was from 114 000 to 182 000 calories.

5) The daily absolute increase in weight varied from 153 to 372 gms. Per 100 kg. of live weight it varied between 1.7 and 3.8 kg. Two factors

(1) See also *B.* December 1914, No. 1148. (*Ed.*).

(2) See also the original articles: 1) Prof. Paul Schuppli, Calf Rearing on the Emulsion System, *B.* Feb. 1913, pp. 167-173; and 2) Prof. Antonio Pirocchi, Utilisation of Skimmed Milk as Food for Calves, *B.* Aug. 1913, pp. 1157-1164. (*Ed.*).

which favourably influenced increase in weight were, on one hand, the younger age of the animal, and on the other, the diafarinised milk rich in carbohydrates. The youngest animals on a diet of milk, rich in carbohydrates and consequently with a narrow nutritive ratio, required for a given increase in weight a smaller quantity of food than the older animals or those fed on milk rich in fat, that is to say with a wider nutritive ratio. The watered milk, which in comparison with the remainder, gave a smaller number of calories markedly increased the intake of nutritive matter. For 1 kg. increase in live weight the animals required from 1.12 to 1.82 of starch equivalent.

6) The animals assimilated from 46.3 to 83.7 per cent of the protein ingested.

The lesser age of the animals and the wider nutritive ratio had a favourable influence on the utilisation of protein. The pigs absorbed daily per 100 kg. of live weight from 58.6 to 136.9 gms. of nitrogen of which 13.6 to 57.0 gr. were excreted in the urine ; the quantity of nitrogen stored varied from 41.5 to 105.1 gr. The amount of protein decomposed depended not only on the nutritive ratio of the food but more particularly on the quantity of protein digested per unit of live weight. On account of their great growing powers per unit of weight, young pigs can assimilate 3 to 4 times the quantity of protein assimilated by calves of the same age.

The data on nitrogen metabolism showed that per 1000 kg. of live weight the pigs required daily from 0.9 to 1.0 kg. of digestible protein for maintenance and 5.3 to 6.3 kg. for production, or a total of 6.2 to 7.5 kg. of digestible protein. An excess of protein ingested is decomposed in 4 to 12 weeks ; on the other hand a smaller allowance of protein does not increase the amount of body protein in proportion to the growing power, even when the increase in body weight is otherwise satisfactory.

The milk rich in carbohydrates had a more favourable influence on the assimilation of the protein than the fat milk ; the action of the watered milk was not so favourable.

7) The ingestion of a greater quantity of carbohydrates did not alter the relative physiological value of the milk utilised, but the effect of the diafarinised milk with the wide nutritive ratio was to lower it.

The pigs fed on the milk with a wide nutritive ratio (rich in fat) stored, during a period of given increase in the live weight, a smaller quantity of nitrogen ; they consumed, however, a larger amount of energy. The effect of the wide nutritive ratio is to produce less flesh but more fat. In any case the storage of protein in a growing organism requires a relatively larger quantity of energy than does the accumulation of fat.

The animals fed on diafarinised milk excreted a relatively smaller quantity of urine than those fed on emulsion milk. The tissue formed by the milk of high carbohydrate content is likely to be more watery, as with pigs reared on diafarinised milk, the larger the amount of water retained the smaller the consumption of energy. The milk with the high water content increases the consumption of energy.

8) The experiments have proved that the daily requirements of

young, actively growing pigs 5 to 12 weeks of age, 5 to 18 kg. live weight, are 180 000 digestible calories, of which 22 per cent is furnished by the digestible protein, or 6.8 kg. of digestible protein and 36.4 kg. of starch equivalent. The results obtained thus agree closely with KELLNER's standards both for the quantity of protein and the amount of starch equivalent.

As a result, in the feeding of young pigs which have been weaned, the nutritive ratio should not exceed 1 :5. A wider ratio often causes digestive troubles and impairs growth, even when the actual increase in the live weight is satisfactory.

In view of the fact that a diet rich in carbohydrates has a favourable influence on : consumption of food, increase of live weight, nitrogen metabolism and utilisation of energy, it is advisable from an economical point of view, to feed as large a quantity of these substances as possible. At the same time this should not be effected at the expense of the fats, or otherwise a certain flaccidity of tissue and possibly disease of the bone, may result, even when the foods contain a sufficient quantity of calcium salts phosphates.

A diet rich in carbohydrates or in fats also affected the external appearance of the animal. The animals fed on the diafarinised milk remained of the low, long, broad form associated with early maturity. The milk rich in fat, on the other hand, favoured the development of the deep form with firm flesh.

POULTRY

90 – **The Effect of Pituitary Substance on the Egg Production of the Domestic Fowl** (1). — CLARK, LEWIS NEILSON, in *The Journal of Biological Chemistry*, Vol. XXII, No. 3, pp. 485-491, 3 tables. Baltimore, Md., October 1915.

The relation between the pituitary gland and the genital system led the writer to test the effect of this gland on the ovulation of the domestic fowl.

The pituitary substance was prepared from the brains of growing mammals, only the anterior lobe of the gland being employed, and administered in the form of a powder, an amount equivalent to 20 mg. of fresh pituitary substance being fed to each hen per day.

The birds used were Single Comb White Leghorns. The conclusions derived from the experiment were as follows :

1. Feeding of pituitary gland substance (anterior lobe) increased the egg production of hens whose production curve was on the decline : Case 1, with 35 hens in isolated pens ; Case 2, with 655 hens.

2. The dosage was effective on the fourth day after the first dose and lasted for several days after the last dose.

3. The fertility of eggs from dosed parents was increased.

The writer considers that the negative results obtained by previous workers are possibly capable of explanation by the fact that their material was probably taken from adults, in contrast to his own, which was derived from growing animals.

(1) See also *B.* Aug. 1915, No. 838. (*Ed.*)

91 - **On the Partial Disinfection of Mulberry Leaves for Silk-worms.** — CARMI, A. in *Le stazioni sperimentali agrarie italiane*, Vol. XLVII, Part 10-11, pp. 717-738. Modena, 1915. SILKWORMS

The writer examines the general importance of the bacterial flora of the food, stomach and intestine in digestion, and summarises the results of the researches on this subject with silk-worms (which having an entirely cutaneous respiration are normally excluded from aerial infection and are adaptable to experiments under sterile conditions) carried out by LO MOMACO, PIGORINI, BUCCI, VERSON, GUARNERI, PASSERINI and MARCHI, and by CISGATO and CERATO, who employed as sterilising solutions: "tachiol Paternò" (fluoride of silver) 1 part in 100 000 or 1 in 150 000 or lysoform 0.05 per cent, 0.3 per cent and 0.5 per cent with varying results. The experiments, of the writer carried out at the Royal School of Zootechny and Cheese-making at Reggio Emilia under practical conditions, were made in duplicate using 500 silk-worms in each experiment. Disinfection was effected with lysoform in 0.5 per cent solution renewed daily. According to GUARNIERI this solution allows a more prolonged immersion of the leaves without loss of its efficiency. The leaves were immersed for 30 to 35 minutes, left to drip and then fed to the silk-worms (Chinese) whilst still wet, five times a day beginning with the second moult. A more irregular growth, diminished apetite and a greater mortality, and later a slight general restlessness were observed among the lots so fed. The treated lots gave 445 and 461 cocoons weighing respectively 700 and 770 gms. The controls gave 400 and 477 cocoons respectively weighing 780 and 850 gms. The results were therefore uniformly negative.

The writer does not exclude the possibility of obtaining better results, by using during the early stages, a 0.2 or 0.3 per cent solution of lysoform. He concludes, however, that disinfection of leaves gives results too uncertain to recommend its adoption on a large scale, especially taking into account the increase of manual labour and expenses caused by the necessity for more extensive accommodation.

92 - **Experiments on the Toxic Action of Acids and Alkalis upon Fish.** — UNGER, EMILE in *Kisérletügyi Kozlemények*, Vol. XVIII, Part, 2, pp. 373-381, 14 tables. Budapest, 1915. FISH

The present contribution to the subject is the result of numerous experiments carried out over a number of years at the Royal Hungarian Station for the Study of Fish Life and Water Pollution. The results of previous experiments of the same kind were published in 1909 and 1912.

In addition to former experiments described in the literature of various countries, (the results of which the writer does not consider very conclusive), experiments are actually in progress on this subject in the United States. The first American investigators were H. W. Clark and C. Adams; at the International Congress of Applied Chemistry held at New York in 1912, these gentlemen lectured on *Studies of Fish Life and Water Pollution* and described the results of their experiments carried out at the Massachussetts Institute of Hygiene (1).

(1) See: *Enginering News*, February 13, 1913.

The acids and alkalis frequently used in factories occur in the waste water from these concerns and are thus the cause of damage. It is with such substances that the writer has made his experiments: hydrochloric, sulphuric and nitric acids, and, among the alkalis: caustic soda, caustic potash and ammonia.

In order to examine the particularly toxic effect of ammonia the writer has also experimented with ammoniacal salts: carbonate, sulphate and nitrate of ammonia. Experiments were begun on trout, various kinds of bleak and young carp, but later on, as these latter (which had been taken from various ponds) were infested with different parasites (*Costia*, *Gyrodactilus*, *Argulus*,) they were removed and replaced by common perch (*Perca fluviatilis*). The results are given in considerable detail and show: the toxic substances; their amount; the length of the experiment; the temperature of the water and behaviour of the fish during the course of the experiments.

The following conclusions may be drawn from the results:

1) Hydrochloric, sulphuric, and nitric acids in a free state have a toxic effect upon fish, the presence of even the smallest quantities of these acids being sufficient to cause death. For instance in one experiment 2.5 mg. per litre were sufficient.

2) The effect of caustic potash and caustic soda is not as noxious as that of the acids. The fish were able to survive in a medium containing 30 to 100 mg. of these alkalis to a litre of water (Experiments lasting 15 days). The degree of resistance varies in different species.

3) Ammonia is more dangerous to the life of fish than fixed alkalis. In solutions containing 10 mg. of $NH_3$ per litre of water, all the fish were dead at the end of a few hours. Only in the case of solutions containing from 0.5 to 0.75 mg. $NH_3$ per litre of water did the fish survive for the whole 15 days of the experiment.

4) The noxious action of the acids and of fixed alkalis (potash and soda) can be considerably diminished or even eliminated entirely, by means of diluting them sufficiently.

5) On the other hand, the specific and very strong toxic effect of ammonia and its salts cannot be overcome; at most it can be diminished to an inconsiderable extent. The fatal effect of these compounds on the fish must be atributed to the well-known toxicological fact that they have the property of paralysing the nerve centres of the respiratory organs, thus producing asphyxia.

It results from these experiments that such measures as are possible should be taken to prevent waste water containing ammonia or its salts from being diverted into streams or rivers containing fish.

93 – **The Breeding of "White Fish" (*Coregonus* spp.) in Switzerland.** — SURBECK, G. in *Schweizerische Fischerei-Zeitung*, Year 23, No. 11, pp. 296-305. Pfäffikon (Zürich), November 1915.

The species of fish of the greatest economical value to the fishing industry of the Swiss lakes belong to the genus *Coregonus*.

Artificial hatching and stocking have been practised in Switzerland

for a good many years and have already exerted a favourable influence upon the numbers of fish of this genus and consequently also upon the fishing returns. The following table gives the numbers of *Coregonus* fry that have been introduced under State control into the lakes of Switzerland. The larvae all came from Swiss hatcheries.

| | |
|---|---|
| 1905-06 | 46 322 000 |
| 1906-07 | 37 873 000 |
| 1907-08 | 40 786 000 |
| 1908-09 | 43 581 000 |
| 1909-10 | 58 618 000 |
| 1910-11 | 50 441 000 |
| 1911-12 | 56 292 000 |
| 1912-13 | 70 809 000 |
| 1913-14 | 75 435 000 |
| 1914-15 | 96 544 000 |
| Total 1905-1915 | 576 701 000 |

The number of young fish used annually for stocking purposes has thus been more than doubled in the space of 10 years. Of the 212 fish-hatcheries existing in Switzerland in 1914-1915, 38 were engaged in breeding from *Coregonus* ova. The total number of larvae of all species supplied by these establishments for restocking Swiss waters amounted in 1914-1915 to 127.5 millions as against 109 millions in the preceding year. *Coregonus* larvae thus accounted for 76 per cent of the total number reared. The proportion of succesful hatching in the 32 establishments above mentioned was 82 per cent. and the average production of larvae of lake herring is 2 540 000 for each.

The following table gives the absolute number and the relative number per acre of surface of the larvae used for restocking the various Swiss Lakes with *Coregonus* in 1914-1915.

| Lake | Area in square miles | Absolute number | Relative number per acre of surface |
|---|---|---|---|
| Leman (Swiss portion) | 139.8 | 725 000 | 49 |
| Lugano (Swiss portion) | 7.53 | 95 000 | 124 |
| Brienz | 11.57 | 260 000 | 222 |
| Maggiore (Swiss portion) | 16.28 | 520 000 | 297 |
| Wallenstadt | 8.99 | 380 000 | 395 |
| Bienne | 16.18 | 866 000 | 494 |
| Four Cantons | 44.60 | 3.652.000 | 741 |
| Zurich | 33.90 | 3 493 000 | 988 |
| Klöntal | 0.50 | 50 000 | 1 038 |
| Aegeri | 2.70 | 500 000 | 1 730 |
| Neuchatel | 92.54 | 18 098 000 | 1 977 |
| Sarnen | 2.95 | 870 000 | 2 718 |
| Constance | 68.36 | 20 580 000 | 2 965 |
| Greifensee | 3.27 | 1 420 000 | 4 201 |
| Zug | 14.77 | 7 573 000 | 4 942 |
| Baldegg | 2.02 | 1 150 000 | 5 436 |
| Thun | 18.51 | 10 900 000 | 5 684 |
| Pfäffikon | 1.27 | 1 200 000 | 9 143 |
| Sempach | 5.55 | 7 336 000 | 12 603 |
| Hallwil | 3.98 | 16 876 000 | 40 526 |

The total superficial area of these 20 lakes only reckoning the Swiss portions of those lakes crossed by the frontier, is roughly 494 sq. miles. The total number of *Coregonus* larvae introduced into these lakes in 1914-1915 was 96 544 000, the average number per acre of surface being 1863. If this figure could be raised to about 7 400, it would be possible to quadruple the present rate of catch. That this is possible is proved by the fact that the number of these fish per acre of surface shows enormous variation, rising from 49 to over 40 500. Nor would there be any lack of food, for all these lakes are very rich in plankton which is the chief food of this group of fishes.

Basing his estimate on the data furnished by the fishery statistics of Lake Constance and on a calculation of the catches on the lake of Neuchâtel (according to Vouga's method) the writer reckons that the weight of the lake herring or white fish annually caught in the Swiss lakes is about 2 640 000 lbs. This represents a value of 80 thousand to 100 thousand pounds sterling while the total gross returns from all species of fish for the whole of Swiss waters is estimated at 320 thousand pounds sterling.

OTHER LIVE STOCK

94 – **Silver Fox Farming in Eastern North America** (1). — DEARBORN, N. (Assistant Biologist) in *United States Department of Agriculture, Bulletin No.* 301, 35 pp. 22 figs. Washington, D. C. October 29, 1915.

The name " silver fox " as commonly used by furriers includes the dark phases of the ordinary red fox (genus *Vulpes*) variously called silver, silver gray, silver black or black. The natural habitat of red, cross (hybrids between silvers and reds or descendants of such hybrids) includes the greater part of North America, from central United States northward to and including the treeless tundras. The red phase inhabits all this region, but the silver phase, though known from most parts of it, is very irregularly distributed. The best pelts are obtained only from foxes in the more northern latitudes.

The large profits realised by the pioneers of fox ranching have transformed this industry from a secret enterprise into a widely heralded speculation, with not always healthy results. On the other hand, with the comparatively large numbers of silver foxes in domestication, a clearer understanding of their management, and with a return of moderate prices for breeders, a steady, healthy and general development of silver fox farming may be expected.

A fox ranch should be situated where it will have good drainage and be partially shaded by a young growth of deciduous trees. Each pair of foxes should have a runway of about 2 500 square feet. They thrive on a varied diet, including meat, fish, bread, mush, milk and table scraps. The reproductive period is about 10 years. The young are born in April or May, the average litter containing four cubs; but only about half of the captive females produce young in any given year.

Foxes bear captivity well. No widespread disease has appeared among them. Wounds heal readily, and cases of sickness are usually

(1) See also *B.* Aug.-Sept.-Oct. 1911, No. 2854. (*Ed.*)

ttributable to a lack of proper care. Much can be effected by means of elective breeding.

The cost of yards runs from $ 100 to $ 150 each, and that of the animals rom $ 150 to $ 250 for common silver foxes up to several thousand dollars or the best silvers.

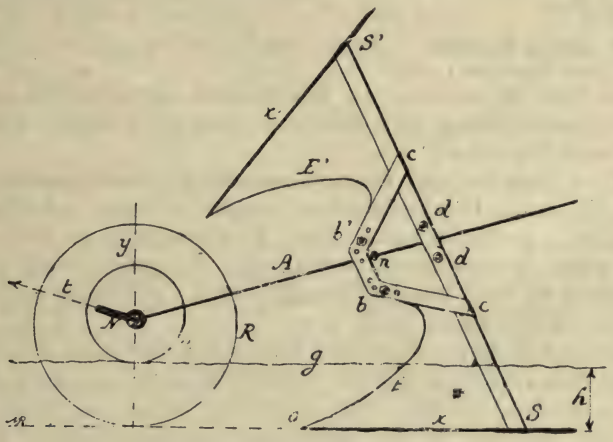
## FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

95 - **Dreux-Brézés Double Flemish Plough.** — RINGELMANN, MAX, in *Journal d'Agriculture Pratique*, Year 79, No. 59, pp. 599-602, 4 figs. Paris, November 4, 1915.

For a number of years past, Count E. de Dreux-Brézé has used, on his estate at Lurcy (Nièvre, France) where there is much heavy clay land, certain ploughs invented by him. They are built in the country, the cast iron Dombasle plough frames made by a neighbouring foundry being used for the purpose. The principle upon which they are designed is shown in the accompanying figure.

On the axle of the two wheels $R$ and $r$ the head of the flat iron plough beam $A$ is mounted, while the other end passes through two parallel guides




Dreux Brézé's Double Flemish Plough

$cb\ b_1c_1$. The front cast iron standards of the frames $E\ E_1$ are bolted between the guides. The rear standards $SS_1$ are formed by two parallel wrought iron flat bars which connect the soles $x$ and $x_1$ to the guides $cb\ b_1c_1$ to which the coulters are attached by clamps.

The vertical play of the plough frames relatively to the beam $A$ is adjusted by the position of the two pins passing through the holes $bb_1$ in the guides. The beam $A$ slides between two other pins $d\ d_1$ fixed to the rear standards $SS_1$.

As the fig. shows, the construction and working of the plough is very simple. The draught on the hake *t* at the head of the beam *A* is transmitted to the guides *bc* $b_1c_1$ by a pin *n* and thence to the frame *E S* while the beam works between the bolts $b_1$ and $d_1$. In the beam *A* some holes are pierced thus allowing of several positions of the pin *n*. which adjusts the parallelism of the sole *x* with the land according to the required depth *h* of the furrow by varying the distance of the point *o* of the share from the vertical projection of *y*. *N* is a hake with five notches for regulating the width of the furrow.

At the end of the furrow the ploughman swings the whole plough over the wheels by means of the rear end of the beam which is made especially long to give more leverage for this purpose.

For ploughing ro a depth of 10 to 12 inches in clay soil, six to eight bullocks are necessary.

For breaking up land to a depth of 16 inches, one of the ordinary ploughs, say the right hand one, is left in its place and the other one is replaced by a special left hand plough, and the furrow is opened in two times. The first plough goes to a depth of 10 to 12 inches, and the second, on the return journey in the same furrow, goes 4 to 6 inches deeper. For this work four pair of oxen are necessary.

For the ploughing of old forest land one of the ploughs is replaced by a strong coulter.

96 – **Kapok Carding Machine.** — BOYER, JACQUES in *La Nature*, No. 2201, pp. 363-367, 5 figs. Paris, December 4, 1915.

Kapok fibre is produced by *Eriodendron anfractuosum* and *Bombax ceiba*. At present about fifty estates in Java grow kapok while a dozen years ago only five did so.

The Java fibre is about 15 to 30 mm. long ; it is monocellular, cylindrical and full of air. It is besides impermeable to water and when moistened dries quickly so that it never rots. Its lightness is so great that when placed in water is bears 30 to 35 times its own weight while cork hardly bears 5 times its own weight, kapok is thus admirably suited for the manufacture of life buoys, belts, etc.

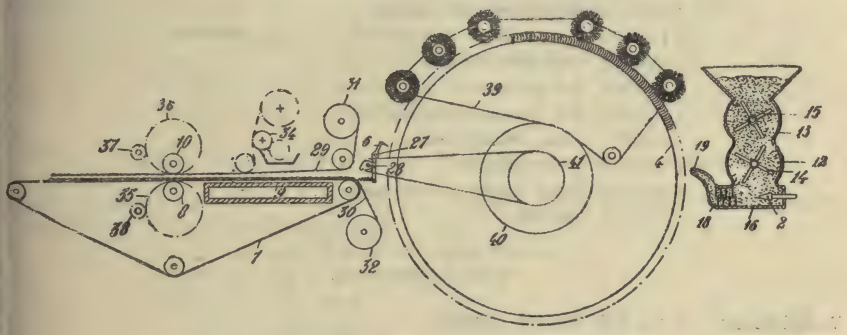
Hitherto all attempts to convert the ginned fibre into sheets like wadding or into ribbons, as the first step towards spinning, had been unsuccessful because the carding machines, broke the fine fibres and reduced many of them to dust. Recently, M. de Saint-René has, after several year's work, devised a carding machine which arranges the fibres parallel to each other without breaking them and then suitably heats the sheet of wadding that is formed and causes the fibres in it to curl and to interlock.

The ginned kapok is thrown into a hopper (see fig.), placed over two cylindrical boxes, 12, 13, situated one over the other, in which crosses 14, 15 revolve in opposite directions. The fibre then falls into a box 16, through which a current of air from the nozzle 2, is injected and conveys the kapok to a slot 19, of a length equal to the breadth of the carding drum 4. The interior of the space 18, is provided with needle-like points which tend to loosen the flocks.

The bent wires on the carding surface are attached to a very flexible issue and so arranged as not to break the fibre. The drum revolves in the irection contrary to the hands of a watch and carries the fibres under ix rotary brushes 5, placed above the drum and consisting of soft flexible ufts mounted on wooden rollers. The bearings of these rollers can be aised or lowered at will by means of a winch.

Diametrically opposite to the slot 19, a comb 6 is placed parallel to he drum with the object of detaching the sheet of kapok fibres and laying t on the receiving endless apron 7. The comb is kept away from the drum y a spring, but it is pressed against it by a cam when the drum revolves ackwards.

When the machine is set going a sheet of kapok fibres is gradually ormed round the drum. When it is of sufficient thickness the roller brushes




Kapok carding machine. — Longitudinal section.

re lifted and the motion of the drum is reversed, the comb then detaches he sheet of kapok from the drum and places it on the conveyor apron 7. n passing over the box, 9, where it is heated, the fibres curl and hook on o each other by their ends without losing their parallelism. The sheet then asses between the compressing and smoothing rollers.

In order to render the carrying of the sheet easier it may be placed etween two sheets, 29, 30 of muslin, paper or similar material paid out rom the rollers 31 and 32.

For spinning the fibre M. de Saint René uses a liquid (the composition f which is not stated) which causes the fibre to agglutinate without losing ny of its properties and thus form a yarn by the adherence of one fibre to nother as is the case with wool and cotton fibres.

With the yarn thus obtained worsted and woven goods have been uccessfully prepared.

## 97 – Review of Patents.

*Tillage machines and implements.*

Switzerland 71 152. Fastening for the handles of agricultural implements.

United Kingdom 16 576. Cultivator.
16 956. Track marker for drill ploughs.

United States 1 153 916. Ditching machine.
1 153 952 — 1 154 084 — 1 154 841 — 1 155 569 — 1 155 833 — 1 155 569 — 1 157 433.. Cultivators.
1 154 307 — 1 155 418 — 1 155 917 — 1 156 831 — 1 157 399 — 1 158 034. Ploughs.
1 154 790. Rake.
1 154 889. — 1 157289. Motor ploughs.
1 154 995. Ploughing machine.
1 155 192. Combined harrow and cultivator.
1 155 349. Disk jointer for ploughs.
1 155 854. Mouldboard for ploughs.
1 156 611 — 1 157 680 — 1 157 706 — 1 157 812. Harrows.
1 156 843. Disk harrow.
1 156 873. Soil pulverizer.
1 156 968. Self dumping drag harrow.
1 157 067. Gang plough frame.
1 157 136. Gang plough.
1 157 150. Weed cutter or cultivator.
1 157 295. Subsoiler.

*Manure distributors.*

United States 1 154 236. Manure spreader.
1 155 204 — 1 157 370. Fertilizer distributors.
1 157 532. Two row attachment for fertilizer distributors.

*Drills and sowing machines.*

United States 1 154 173. Plant setting machine.
1 154 765. Seed-potato cutter.
1 155 598. — 1 157 501. Corn planters.
1 157 155. Harrow attachment for seed drills.
1 158 031. Potato planter.

*Reapers, mowers, and other harvesting machines.*

United Kingdom 16 459. Improvement in combined side delivery rakes, swath turners and tedders.

United States 1 153 968. Cotton harvester.
1 154 037. Harvester.
1 154 368. Peanut harvester.
1 154 493. Grain header.
1 154 542. Loading attachment to binders.
1 154 595. Header attachment for engines.
1 154 662. Combined motor vehicle and mower.

1 154 703. Controlling mechanism for tractor driven headers.
1 155 305. Attachment for mowing machines.
1 155 827 — 1 157 857. — Corn harvesters.
1 155 860. Cord knotter for grain binders.
1 155 988. Mowing machine.
1 156 216. Tongue truck for harvesters.
1 156 575 — 1 158 050. Harvesting machines.
1 156 734. Hay or shock loader.
1 157 056. Motor attachment for harvesters.
1 157 680. Hay loader.
1 157 775. Side delivery hay rake.

*Machines for lifting root crops.*

United States 1 157 931. Machine for digging potatoes.

*Threshing and winnowing machines.*

United States 1 154 102. Apparatus for cleaning and separating seeds and grain.
1 155 155. Corn shelling machines.
1 155 173 — 1 157 038. Corn husking machines.
1 156 395. Threshing machine.
1 156 478. Husking device.

*Machines and implements for the preparation and storage of crops.*

United Kingdom 16 183 — 16 356 — 16 444. Machines for preparing fibres for spinning.
United States 1 154 262. Straw bruiser.
1 154 464. Stalk header and ensilage cutter.
1 155 543. Baling press.
1 155 889. Corn drier.
1 156 786. Potato sorter.
1 156 828. Hay baler.

*Other agricultural machines and implements.*

British India 2 072. Oil and sugarcane expressing mill.
Cuba 2 341. Apparatus for expressing the residues of industrial plants.
2 343. Process for applying the gaseous products of combustion to the manufacture of sugar.
Switzerland 71 032. Process and apparatus for extraction of nicotine and ammonia during the evaporation of tobacco lyes.
United Kingdom 15 920. Garden frame.
17 024. Apparatus for extracting nicotine and ammonia from tobacco.
United States 1 153 983. Fence post.
1 154 073 — 1 156 428. Hog feeders.
1 154 104. Draught equalizer.
1 154 322. Tractor.
1 154 404. Crank and lever mechanism for windmills.
1 154 768. Stock trough.
1 145 930 — 1 155 518 — 1 157 383. Windmills.
1 156 203. Traction engine.
1 156 622. Spraying attachment for cultivators.
1 157 025. Fruit picker.
1 157 324 — 1 157 551. Wire fence stretchers.

BUILDING CONSTRUCTION

98 – **Pits for Winter Gardening.** — CUMMISKEY, CHARLES J. in The *Country Gentleman*, Pol. LXXX, No. 43, p. 1621. Philadelphia, October 23, 1915.

The natural heat of the earth, if properly utilised, is sufficient to grow flowers and vegetables even in winter. The temperature of the earth during midwinter at a distance of 12 to 15 feet below the surface is from 45 to 50° F.

Frederick W. Taylor some years ago solved the problem of using this natural heat and obtained wonderful results by means of earth pits.

*Pit for winter gardening.*

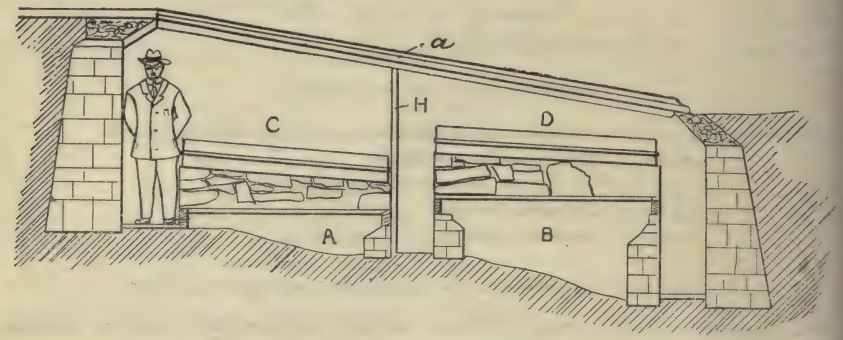



Fig. 1 — Cross section.

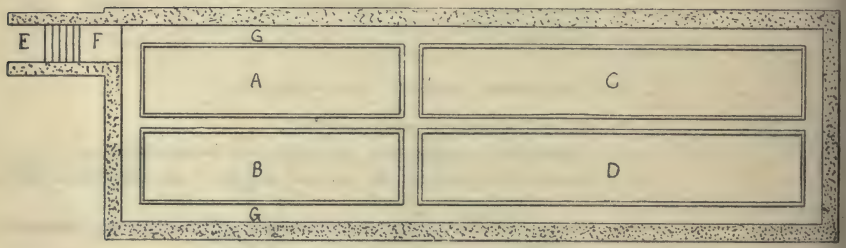



Fig. 2. — Plan.

These pits are entirely under-ground (fig. 1 cross section, fig. 2 plan.). They face south and are covered by a sloping glass roof *a* and are heated solely by the natural heat of the earth supplemented by sun heat.

Records of temperature have shown that during the coldest season when the outside temperature dropped to 13° F. below zero the temperature inside the pit registered 41° F. above zero. Heavy snow has formed a blanket on the top for 3 or 4 days without injury to the plants. The average inside temperature during the day when the sashes are open to air the plants is from 55 to 60° F., at night the average is about 48° F. above zero.

The bank walls are constructed of stone, laid with loose joints to permit all possible heat to radiate into the pit ; for 30 inches from the surface, however the walls are laid in cement to prevent frost movement. The walls under the plant beds are of stone also laid with loose joints. The roof consists of units of sash, each 4 × 9 feet, supported upon T irons. Each sash is double glazed with an air space between the two layers of glass. Gutters are provided to catch the condensed moisture.

As the weather becomes colder the sashes are covered at night with well fitting padded canvas covers battened down.

According to the outside temperature the sashes are lifted to air the pit in the morning.

Entrance is gained at the west end of the pit by a short flight of stairs *E* leading to a vestibule *F* formed by double folding doors. Round the beds *A. B. C. D.* runs a path *G*, and iron pipe columns *H* support the roof.

A great variety of vegetables can be grown this way and the pits may also be used to start plants, such as tomatoes, for open ground cultivation.

The principle of these pits has been patented. A number of them are now in use and some have merely earthen walls or are banked with boards.

## RURAL ECONOMICS.

99 – **The Farmer's Response to Economic Forces.** — SPILLMAN, W. J. in *The Economic World*, New Series, Vol. X, No. 12, pp. 326-365. New York, 18 September, 1915. RURAL ECONOMICS

Radical changes in systems of farming can only occur under the stimulus of strong economic forces, as for example :

1) *the introduction of a new enterprise*, more profitable than those previously followed (cultivation of the cigar wrapper tobacco in the Connecticut Valley, of cotton in the south of the United States) ; 2) *the appearance of some disease or pest* which may attack certain crops to such an extent as to render them unprofitable ; 3) *the development of transportation facilities* which render possible an agricultural enterprise which was previously impossible because of the difficulty of transport and of marketing produce (thus in Chester County, Pa., such facilities and the permanent rise in prices for dairy products consequent on the increasing demand from Philadelphia, have made it possible to substitute the intensive dairy enterprise for the extensive enterprise of stock farming ; 4) *the advent of a rival industry* which obliges the farmer to adopt an intensive system of farming.

In those localities where, for a certain time, economic conditions have remained stable, local agricultural practice has generally acquired an organisation which, from an economic point of view, best (or at least approximately so) corresponds to these local conditions. There are, however, always some slight variations in the economic conditions to which the farmers are continually endeavouring to readjust themselves, developing systems which represent optimum practice under prevailing economic conditions. The principal object of the paper it to point out a method by which these smaller forces may in many cases be measured, and which therefore renders possible a more prompt adjustment of agricultural practice to slight changes in economic conditions.

For this purpose use is made of the data furnished by an inquiry into the conditions of organisation and labour income of 378 farms in County Chester, carried out in the business year 1911-1912. These farms are divided by the writer into groups according to percentages of hay acreage, and the average labour income of each of these groups arrived at in the following manner: — since the magnitude of the farm business is in this case the most important factor causing variations in labor income, these farms were first divided into groups based on magnitude of business. The average labour income of each of these groups was determined, and the labour income of each farm then expressed in percentage of the average of its group. By this process the influence of magnitude of business on the labour income is eliminated. The writer calls the percentage thus obtained the «adjusted labour income». The farms are further grouped according to their crop acreage of *wheat, fruit, maize* and *oats* and the adjusted labour income is calculated for each of these groups. The results are given in the following Table:

TABLE I. — *Crop Area Percentages in Relation to Labour Income.*

| | | | | | | |
|---|---|---|---|---|---|---|
| I. *Hay* | Percentage area | 0–29 | 30–39 | 40–49 | 50–59 | 60 + |
| | Number of farms | 33 | 107 | 145 | 74 | 19 |
| | Adjusted labour income | 96 | 93 | 107 | 105 | 72 |
| II. *Wheat* | Percentage area | 0–9 | 10–19 | 20–29 | 30 + | — |
| | Number of farms | 26 | 213 | 121 | 16 | — |
| | Adjusted labour income | 63 | 107 | 97 | 96 | — |
| III. *Fruit* | Actual area-acres | 0 | 1–4,9 | 5 + | — | — |
| | Number of farms | 63 | 306 | 9 | — | — |
| | Adjusted labour income | 91 | 103 | 43 | — | — |
| IV. *Maize* | Percentage area | 0–9 | 10–19 | 20–29 | 30–39 | 40 + |
| | Number of farms | 4 | 134 | 188 | 42 | 10 |
| | Adjusted labour income | 63 | 95 | 102 | 121 | 52 |
| V. *Oats* | Percentage area | 0 | 1–9 | 10 + | — | — |
| | Number of farms | 140 | 141 | 97 | — | — |
| | Adjusted labour income | 117 | 102 | 73 | — | — |

It will be seen that the group having 40-49 per cent of their crop acreage devoted to *hay* made the highest average labor income. Those having 50-59 per cent of hay acreage come next. Those having 60 per cent or more and those having less than 40 per cent of hay acreage made labor incomes less than the average. It is of interest to note that the largest number of farms in any group is the one having what may be called the optimum percentage of hay acreage. The average percentage of this crop for the entire 278 farms is 44, which is almost exactly at the centre of this optimum group. In recent years there has been no particular change in the conditions affecting the profitableness of this crop, and the farmers have had time to adjust their practice to the economic forces which tend to drive them in the direction of the greatest profit. Another point of interest, however, is that

more than one-third of the total number of farmers are outside of the two groups in which the labor income is higher than the average.

The farms grouped according to their *wheat* acreage give similar results. The majority of the farmers had found the proper status of the wheat crop in their system of farming. Nearly two-third of them, in fact, are in the one group showing the highest average labor income. The average for all farms is 18.2 per cent, which is also in this group.

This is also the case for the farms grouped according to their area under *fruit*; the figures are given in acres instead of percentage of crop area, this being about the same on farms of all sizes. In Chester County the soil does not seem to be adapted to fruit growing. The average surface thus cultivated on all the farms is only 1.35 acres. Sixty-three farms had no fruit; their average labor income was 9 per cent below the general average. Three hundred and six farms, more than three-fourths of the whole number, had from 1 to 4.9 acres, averaging 1,5 acres; their labor incomes are 3 per cent above the general average. Nine farms had 5 or more acres; the fact that the average labor income of these 9 farms is less than half of the general average is significant, and still more so when it is added that the largest minus labor income found in this survey was on a farm that had more than fifty acres of fruit.

In contrast to the result given by the three first groups it is found that under the fourth heading, only a small number of farms belong to the group which has the most suitable acreage for maize under the local conditions, and therefore the best labor income. This is explained by the fact that in the case of the maize crop, the stability of conditions has not been maintained as for hay, wheat and fruit; for, about 1895, the price of maize suddenly rose 50 per cent above its former level and has there remained.

The relative acreage of maize is consequently increasing and it is the freely expressed opinion of many progressive farmers of the region that the acreage of maize is not as large as it should be for best results. Finally, the data given in Table I indicate that the most profitable percentage of maize acreage is in the group next higher than that which contains the largest number of farmers.

Census data show that the acreage of *oats* in the country is decreasing. results given in Table I show that those farmers who cut out this crop entirely make the best labour incomes. Their average is 17 per cent above the general average, while that of the 97 farmers who have more than 10 per cent of their land in oats is 27 per cent below the average.

The receipts from *dairy cattle* and their products are in Chester County three times as great as from any other single enterprise. The crop which occupies by far the largest acreage is *hay*. The question arises whether, under the conditions prevailing in this county it is more profitable to feed all the hay grown or to sell part of it. Table II, answering this question, groups the farms respectively according to the percentage of receipts from the sale of hay, corn and poultry. For all the groups so formed the adjusted labour income is again calculated.

TABLE II. — *Relation of Percentage Income from Various Sources to Labour Income.*

| | | | | | | |
|---|---|---|---|---|---|---|
| I. *Hay* . . . | Percentage income. . . . | 0 | 1–9 | 10–19 | 20–29 | 30 + |
| | Number of farms . . . . | 80 | 78 | 114 | 64 | 42 |
| | Adjusted labour income . | 76 | 132 | 112 | 96 | 55 |
| II. *Maize* . . | Percentage income . . . | 0 | 1–19 | 20 + | — | — |
| | Number of farms . . . . | 251 | 121 | 6 | — | — |
| | Adjusted labour income . | 95 | 113 | 53 | — | — |
| III. *Poultry*. . | Percentage income . . . | 0 | 1–19 | 20–39 | 40 + | — |
| | Number of farms . . . . | 8 | 319 | 43 | 8 | — |
| | Adjusted labour income . | 38 | 104 | 97 | 40 | — |

In the first case the greatest number of farmers is found in the group next above that in which the best labour incomes are found. This is believed to be due to the fact that the price of hay was considerably above the normal at the time of the survey, a fact which induced many farmers to sell more hay than usual. The high price of hay did not, however, affect materially the acre value of this crop, for the yield in 1911 was correspondingly low.

The figures of the second section of Table II confirm the conclusions already expressed in connection with maize acreage. The greatest number of farmers is found in the group immediately preceding that in which the best labour incomes are found. The 251 farmers who sold no maize made labour incomes 5 per cent below the average. One hundred and twenty-one derived from 1 to 19 per cent of their receipts from this source ; their labour incomes were 13 per cent above the average.

The number of farms in the group deriving more than 20 per cent. of their income from the sale of maize is too small to give a reliable average ; but the fact that this average is only 55 per cent. of the general average is significant. Evidently it pays to grow somewhat more of both hay and maize than is needed for use on the farm, but that such a practice should not be pushed too far.

The last section of Table II shows the status of the *poultry* enterprise in Chester County. The first and last groups contain too few farms to give reliable averages ; but when it is remembered that the most important fluctuation in labour income has already been eliminated by adjusting the labour income of each farm for magnitude of business, the fact that the average labour income in each of these groups is less than half the general average is not without significance. The very fact that these two groups are so small speaks for itself. More than three-fourths of all the farms are found in the group having the highest labour income while the next largest number is found in the next most profitable class. It follows therefore that in the conditions of Chester County, the poultry enterprise is only profitable up to a certain limit, and furthermore, that the majority of farmers have been able to perceive the proper status of this enterprise which gives the best returns.

The writer draws from this survey the following important conclusion: it is by no means always advisable to increase in magnitude the most profitable enterprises and decrease or eliminate the less profitable or unprofitable according to the accounts in the farm books, because, under the normal conditions of different localities, there appears to be in the case of most farm enterprises an optimum status beyond which either increase or decrease in magnitude reduces profits. This optimum status will, of course, change from time to time and from place to place. Only a carefully conducted farm management survey is capable, in many cases at least, of revealing this status. Such a survey would be a better guide to local farm practice in the matter of the relative magnitude of the various enterprises on the farm than the most carefully kept set of books.

100 – **One-Crop Farming Versus Dairying in Wisconsin.** — RUBINOW, S. G. in *Hoard's Dairyman.* Vol. L, No. 13, Fort Atkinson, Wisc., October 22, 1915.

The writer studies the differences in net returns between typical dairy farms and general farms raising crops as their main source of revenue in Wisconsin. He selected twenty farms to represent each side of the comparison out of the large number that were competing in the Wisconsin Farm Contest, no restrictions being placed on locality, nearness to market, size of farm, size of capital, size of income, or any of the other many factors upon which the net returns depend.

The farms were selected on the basis of the number of cows kept, the average for the dairy farms being forty-one cows and for the general crop farms only four, the animals kept being only those absolutely necessary for working the land. The average acreage of the dairy farms was found to be 216 acres while the general farms averaged only 113 acres. The valuation averaged $ 19 805 and $ 7 569 respectively with an average value per acre of $ 93.99 and $ 66.88.

On the dairy types the buildings were valued at $ 9036, while on the crop farms the buildings were worth only $ 3872.

The average machinery equipment of the dairy farms was $ 1847, the same item for the general farms being $ 746. The cash reserve averaged $ 261 and $ 142 respectively.

The value per cow on the crop farms was $ 64.44, while on the dairy types it was $ 158.36.

The following table shows a comparison of the receipts that represent the average of each set of twenty farms:

*Comparison of Receipts.*

| | Dairy farms | General farms |
|---|---|---|
| Crops | $ 1 187.76 | $ 1 056.24 |
| Live stock | » 4 392.90 | » 956.81 |
| Live stock products | » 4 337.44 | » 314.30 |
| Miscellaneous | » 2 439.50 | » 801.41 |
| Total receipts | $ 12 357.60 | $ 3 128.76 |
| Total capitalization | » 41 208.18 | » 13 719.51 |

This table shows that the dairy farms not only raise as much crops as are grown on the general farms but in addition are making a great deal more profit from their live stock, both through the sale of live stock products and through the sale of live stock or increased inventory.

The following table shows a comparison of the expenses for each set of farms and the resulting net returns :

*Comparison of Expenses and Profits.*

| | Dairy farms | General farms |
|---|---|---|
| Stock purchased | $ 1 792.54 | $ 423.35 |
| Improvement and equipment | » 1 293.14 | » 481.61 |
| Feed | » 824.16 | » 127.97 |
| Supplies and seeds | » 157.70 | » 108.95 |
| Labor | » 1 906.38 | » 524.79 |
| Miscellaneous | » 1 581.90 | » 337.74 |
| Interest (5 %) | » 2 067.88 | » 632.40 |
| Total expenses | $ 9 623.70 | $ 2 636.81 |
| Net profits | » 2 733.90 | » 491.95 |

Those figures illustrate the whole agricultural history of Wisconsin. In 1859 Wisconsin held first place as a wheat growing state. Grain growing on the one-crop method followed year after year rapidly exhausted the soil, yields began to fall fast, and one crop after another was lost by the prevalence of insect pests and plant diseases because of the lack of rotation.

Cheaper lands further west more suitable for one-crop farming caused an exodus of people from the State and the farmers that remained in the State recognized that something had to be done to improve the soil and make farming profitable once more. Diversified farming began to creep in until the dairy cow came, stopped the panic and has now made it possible once more to grow grain.

The writer points out that the same conditions prevail now in the South with the only difference that cotton has taken the place of grain in the one-crop method of farming and predicts that Texas will soon follow Wisconsin's example and become the leading dairy state of the South. The dairy cow has become the standard bearer also for the progressive southern farmer.

101 – **Investigations into the Returns of Swiss Agriculture during the Year 1913-1914.** — Report of the Swiss Peasants' Secretariat to the Swiss Department of Public Economy. *Annuaire agricole de la Suisse*, Year 16, (29th of the German edition) pp. 98-258, Berne 1915.

Swiss farming during the year 1913-14 suffered from a series of adverse circumstances, the chief of which may be summarized as follows :

1) A very poor fruit crop.

2) A very poor grape crop.

3) Fall in the price of milk and cheese.

4) Slack trade in live stock, due partly to the spread of foot-and-mouth disease and partly to the fall in the prices of cattle.

5) Fall in the prices of pigs.

6) Increase in the rate of interest on mortgages and on loans in general.

The investigations of the Swiss Peasants' Secretariat into the returns of farming embraced 329 farms each of which produced its account books. The number of balance sheets utilized for compiling the statistical report was 303, with an increase of 12 on the number for 1912.

The following is a brief summary of an examination of the statistical report as to the extent to which the above mentioned unfavorable conditions affected the profits of Swiss farmers in 1913.

On average the cash returns of every farm diminished by about £40 in round numbers or by £1 7*s* 6 $^{3}/_{4}$*d* per acre on an average area of 31.73 acres.

From a closer examination of these returns it appears that the decrease on milk and dairy products was 10*s* 6*d* per acre, on live stock 7*s* 6 $^{3}/_{4}$*d*, on wine 3*s* 5 $^{3}/_{4}$ and on fruit 5*s* 5*d*,

Considering that the production of milk in 1913 was 4.53 per cent. higher than that of the preceding season, the decrease of returns from the dairy is to be attributed to the fall in the prices of milk. On the other hand it is to be noted that the production of milk contributed largely to the increase of returns, so much so that in the period 1906-14 the increase in comparison with the period 1901-05 was 17*s* 2 $^{1}/_{4}$*d* per acre, or 33.85 per cent. In the same period the increase of returns due to cattle and pigs was 4*s* 5 $^{3}/_{4}$ *d* and 3*s* 0 $^{3}/_{4}$*d* per acre, or 21,20 and 27.30 per cent respectively.

Comparing the returns from the live stock industry with those from the crops of arable land and meadows it will be seen that the former amount to 87 per cent. of the total returns and the latter only 5.1 per cent., which proves once more that Swiss farming is based principally on animal husbandry.

The outlay per acre diminished on average by 19*s* 3*d* in comparison with 1912 ; the purchase of live stock figures for 13*s* 1*d*, or decreases by 27 per cent as compared with 1912 being chiefly due to the unfavourable conditions of the live stock market.

The outlay for the purchase of concentrated foodstuffs diminished by 9 $^{1}/_{2}$*d* per acre, but the total outlay remained high and has more than doubled in the period of 13 years. If the general fall in returns be taken into account the outlay of £1 1*s* 10 $^{1}/_{2}$*d* per acre for the purchase of concentrateds is considerable.

The decrease of 3*s* 10*d* per acre (21.08 per cent.) in comparison with 1912 in the purchase of dead stock and in wages of artizans is a character of the year 1913.

The differences in the cash turnover which has been here briefly pointed out, would be enough to prove that 1913 was an unprofitable year for Swiss farming. A more exact measure of such loss is given by the comparison between the years 1912 and 1913 as set forth in the following table, in which is clearly shown to what extent the equilibrium between the cost of production and the value of the produce has been altered.

| Years | 1912 | 1913 |
|---|---|---|
| Number of accounts examined | 296 | 303 |
| | per acre | per acre |
| | £ s d | £ s d |
| Amortisement | 19 4 | 1 4 11 3/4 |
| Decrease of outlay on preparation for crops | 4 1/2 | 3 1/2 |
| Decrease of stock | 3 9 1/2 | 5 3 1/2 |
| Working expenses | 3 1 1 | 2 18 0 |
| Banking account current | 3 1/2 | 7 1/4 |
| Interest on capital, 4 per cent. | 3 14 6 3/4 | 3 15 8 1/2 |
| Cost of labour | 5 6 11 | 5 5 15 1/2 |
| Total cost of production | 13 6 4 3/4 | 13 11 1 3/4 |
| Increase of inventory | 11 10 1/4 | 6 3 3/4 |
| Consumption | — | 2 3/4 |
| Sales account | 16 0 1/4 | 13 11 1/2 |
| Gross produce account | 11 6 1 3/4 | 9 12 10 |
| Complementary accounts | 18 5 1/4 | 18 8 |
| Banking account current | — | 2 3/4 |
| Total gross produce | 13 12 5 1/2 | 11 12 3 3/4 |

This table shows that on average in the 303 farms examined, the produce did not cover the cost of production. The same conclusion is arrived at by an examination of the results of farms divided into classes according to their size, as shown in the following table :

| | Year | Farms | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | under 12.35 acres | | | between 12.35 and 24.7 acres | | | between 24.7 and 37 acres | | | between 37 and 74 acres | | | Above 74 acres | | | Average | | |
| | | per acre | | | | | | | | | | | | | | | | | |
| | | £ | s | d | £ | s | d | £ | s | d | £ | s | d | £ | s | d | £ | s | d |
| Cost of production. | 1913 | 19 | 11 | 3 | 14 | 5 | 3½ | 12 | 3 | 8¾ | 11 | 0 | 5½ | 8 | 18 | 0½ | 13 | 11 | 1¾ |
| Gross produce . . | » | 15 | 4 | 8 | 12 | 9 | 7½ | 10 | 12 | 5¾ | 10 | 3 | 11¾ | 8 | 1 | 9 | 11 | 12 | 3¼ |
| Cost of production. | 1912 | 17 | 7 | 11½ | 14 | 6 | 4¼ | 12 | 7 | 1 | 10 | 19 | 11 | 9 | 10 | 4½ | 13 | 6 | 4¾ |
| Gross produce . . | » | 16 | 4 | 6 | 14 | 9 | 2 | 12 | 19 | 3½ | 11 | 16 | 10½ | 10 | 13 | 2¾ | 13 | 12 | 5½ |

Wages form the principal factor in the cost of production and amount on average to 40 per cent. The influence of the size of the farm reveals itself in a decrease of this item as the acreage increases.

The interest on capital invested absorbs, in round numbers, 29 per cent. of the cost of production, and working expenses 20 per cent. These two items do not vary much with the size of the farm. It is well to note that wages are taken directly from the accounts in the case of salaried hands, while in the case of work done on the farm by members of the farmers' family they are calculated on the basis of local wages. The interest on the capital is taken at 4 per cent.

The portion of the gross produce consumed by the members of the farmer's family diminishes as the farms grow larger. In small farms it attains one-third of the gross produce, in the large ones, only one-fifth.

In 1913 in farms of all sizes, the portion of produce devoted to the farmer's consumption is higher than the average of preceding years, with a remarkable increase in comparison with 1912. This is naturally due to the decrease of the gross produce in 1913 especially of the portion destined for the market. In this respect milk occupies the first place with 25 per cent; the produce of the orchard follows next together with that of the pigstye, 11 per cent each; then wood 6.1 per cent and potatoes 5.4 per cent. On the whole in 1913 the amount of foodstuffs produced in the farm and consumed there was 3*s* 0 ¼*d* per acre less, and the goods taken to market were £1 17*s* 2*d* less than in 1912.

The difference between the gross produce and the total working expenses represented by the cost of production minus the interest on the capital forms the net returns or the actual earnings of the capital. The net returns of 1913 decreased on average by £2 3*s* 9 ¾*d* per acre in comparison with those of 1912 or 54.33 per cent., with an average of £60 13*s* 3*d* per farm while the capital increased on average only by £21 8*s* 2*d* per farm.

The earnings of the capital in the small farms up to 12.35 acres fell from 3.23 to 0.99 per cent and the net returns per acre diminished by £2 12*s* 5 ½*d* or 78.5 per cent., with an average of £23 7*s* 10*d* per farm, together with an increase of capital of £87 4*s* 6*d*.

In farms of 12.35 to 24.70 acres the above earnings fell from 4.09 per cent. to 1.82 per cent. or £2 6*s* 10 ½*d* per acre (56 per cent) with an average of £41 4*s* 8*d* together with an increase of capital of £47 11*s* 7*d*.

In farms betwen 24.7 and 37 acres in extent the decrease of net returns was £2 1*s* 3 ¼ *d* per acre (49.6 per cent) with an average of £70 11*s* 6*d*, while the capital increased by £27 15*s* 1*d*.

The farms ranging from 37 to 74 acres in extent gave the best relative results. The interest on capital fell from 5.01 per cent. to 2.98 per cent. The net returns diminished by £1 16*s* 8*d* per acre or 45 per cent. as compared with 1912, with an average of £90 7*s* 11*d* per farm, while the capital increased by £257 14*s* 3 ¾*d*.

The larger farms between 74 and 173 acres show the lowest returns from capital and the least net returns; the decrease of the latter in comparison with 1912 was £2 1*s* 10*d* per acre, with an average of £187 10*s* 9 ¼*d* per farm while the capital increased by £39 12*s* 11 ¼*d*.

The difference between the theoretical returns of capital and those effectively obtained forms the difference of the net returns; this quantity may

be positive or negative and Laur calls it " écart de rendement " or " Reinertragsdifferenz ". This difference in 1913 was on average — £44 0*s* 2*d* per farm, whilst in 1912 it had been + £17 14*s* 1*d*.

This difference of the net returns expressed in percentage of the gross returns shows by how much per cent the prices of produce should have increased in order to yield the normal interest, or in other terms, to cover the cost of production.

In 1913 the prices of produce should have been 13.24 per cent. higher than what they actually were so as to defray the cost of production.

It is interesting to note that since 1901, that is from the beginning of the investigations by the Swiss Secretariat on the returns of Swiss farming by means of statistics of agricultural bookkeeping, only the years 1907 and 1912 closed with profit, in the strict sense, that is with a positive difference in the net returns.

This was + 14*s* 0 ½*d* (+ 0.23 per cent. of the gross returns) in 1907 and + £17 14*s* 1*d* (or + 4.55 per cent. of the gross returns) in 1912. The average of 13 years, as it results from the examination of 2812 balance sheets was — £14 14*s* 5*d* or — 5.66 per cent of the gross returns.

The capitalization value of the farms which follows the variations of the net returns shows in 1913 a decrease of £55 13*s* 5*d* per acre or 68.20 per cent. in comparison with 1912. If compared with the average of 1901 to 1913 this decrease amounted to £26 6*s* 10*d* per acre or 50.35 per cent.

If the value which is obtained by capitalizing the net returns, in which account is kept of a fair remuneration of the work of the farmer's family and of the interest at 4 per cent. on the capital, be compared with that which appears in the farm inventories, taken generally from the valuations made in cases of division of properties among heirs and the like, and therefore often much inferior to their selling value, it appears that in 1913 it represents only one-third of the valuation as per inventory while in 1910 it was 10 per cent higher than the same. The comparison, with the selling value would be still more unfavourable.

As an average for the period between 1901 and 1913 the capitalisation value was 72.75 per cent. of that which appears in inventories. This ratio however, varies with the size of the farms. Thus it is 41.9 per cent for farms up to 12.35 acres ; 68.55 per cent for those between 12.35 and 24.70 acres ; 80.30 per cent for those between 24.70 and 37 acres ; 87 per cent for those between 37 and 74 acres and 117.90 per cent. for those between 74 and 173 acres.

This proves that the value attributed to farms in cases of inheritance and that which in general is given in the inventories of the farms which have been used as a basis of the statistical bookkeeping investigations of the Secretariat during the last 13 years is all the more unfavourable the smaller the farm and that only the large farms between 74 and 173 acres have been valued in the inventories at a price which was in proportion to the net returns they were able to yield.

102 – **The Investigations of the Institute for Research in Agricultural Economics.** — ORWIN, C. S. in *Institute for Research in Agricultural Economics. University of Oxford. Director's Third Annual Report*, pp. 1-8. Oxford, October 1915.

The work of the Institute during the year 1914, the second complete year of its existence has been carried out according to the plans laid down by the writer, though under considerable difficulty, and included the following research work:

*On the Cost of Production in Agriculture*, the first essential of which is to have access to accurate records of farming costs from a certain number of farms in order to compile statistics from them.

*The Agricultural Survey of Oxfordshire.* — It was recognized that a survey of the general economic conditions controlling the agricultural industry was a necessary preliminary to more particular investigations into the economic conditions of individual farms. The Institute intends to continue these surveys which have begun with that of Oxfordshire now in course of publication. The procedure has been to make a division of the country into its obvious geographical districts and by the study of the agriculture within them and of the available historical and statistical matter to get an insight into the state of the industry. All classes concerned, landowners, land agents, farmers and farm labourers have been consulted in the course of the enquiry.

*Small Holdings and Allotments in Oxfordshire.* — The survey of the small holdings and allotments is being published as an appendix to the county agricultural survey.

*Transport Problems in Agriculture.* — The study of these problems begun in the previous year was suspended in 1914, but, it is hoped, will soon be resumed.

*The Expenditure upon Labour per Acre.* — This inquiry has now been completed, and a report thereon is being prepared. It was undertaken with the object of testing how far the local variations in the rate of agricultural wages affect the cost of farm work.

*Rents and Prices.* — Another inquiry, for which the preliminary steps were taken, was intended to show to what extent the fluctuations in the prices of agricultural commodities are reflected in agricultural rents. Much information on this subject exists in the archives of the great agricultural estates. This inquiry however has had to be postponed.

*Land Reclamation.* — During the year the writer has undertaken the Honorary Secretary-ship of the Land Reclamations Society. There is a good deal of land in the country which is practically derelict and which may have considerable value for farming purposes. One of the objects of the Society is to collect data on the cost of bringing into use certain types of waste land, with a view to an extension of works of reclamation by public or private enterprise, where the possibility of success can be demonstrated.

*Advisory work.* — During the year the Institute received a good many enquiries, both from public bodies and from individuals, in steadily increasing numbers and in proportion as its activities become better known.

103 – **Value of Farm Products in the United States and their Prices at the Far in 1914.** — *U. S. Dep. of Agric. Farmer's Bulletin* 645, pp. 1-45, Washington 191

The total value of all crop production in the United States in 1914 h been slightly less than in 1913 on amount of the reduced value of the cott crop, in spite of the high values of the maize and wheat crops.

The estimated value at the farm of all crops reaches the great total $ 6 044 480 000, which is an amount that is $ 88 279 000 below the total f 1913. Except 1913, the total crop value of 1914 is $ 200 000 000 abo the highest total heretofore reached, which was in the great production ye of 1912.

On the other hand the estimated value of the animal products of th farm in 1914 is distinctly higher than in 1913. This is due to general b slight increases in production, except for sheep and swine, and in price more especially to a small increase in the average farm price of eggs, an to a more considerable increase in the farm price of cattle and calves sol and slaughtered.

The total estimated value of the animal products of the farm and of th farm animals sold and slaughtered in 1914 is placed at $ 3 828 456 000.

This amount is 38,8 per cent of the total value of all farm products an has only been surpassed in 1910 when the percentage was 39.3

The grand total value of all crops, farm animal products, and far animals sold and slaughtered in 1914, according to the detailed estimate that have been made is $ 9 872 936 000. This amount is $ 83 000 000 abo the grand total for 1913, which was itself greatly above the highest tot previously reached.

If the farm value of all farm products in 1899, as ascertained by th census, is regarded as equivalent to 100 the index numbers for 1897, 190 1905, 1910, 1914 are respectively 84.0, 106.2, 133, 191,6, 209.3.

In 1913 the estimated value of total sales per farm was $ 892 and sale per capita of rural population (excluding towns) $ 139.

One of the most satisfactory methods available to show the relativ income of farmers during a long series of years consists in the determinatio of the yearly value per acre of the 10 leading crops combined representin about 90 per cent of the total cultivated area of the United States. An ex amination of the charts and tables prepared by this method shows clearl that from 1870 to 1896 there was a more or less steady tendency toward re duction in the value per acre. In the year 1896 values were at their lowes with $ 7,94 per acre; farming at that time was decidedly unprofitable.

From 1896 to 1909 the value per acre of farm crops increased steadily each year being higher than the preceeding. Since 1909 in which the valu per acre was $ 16,00 it has not changed much, being lowest in 1911 with $ 15,26 and highest in 1913 with $ 16,36; 1914 showed an average of $ 16.27

The prosperity of farmers depends not so much upon the amount o production as upon the total amount of money received for what they pro duce. Thus in 1914 the cotton crops was the largest ever produced, but its value to the farmers was much less than the value of any crop of recent years. On the other hand the maize crop, in total production, is only a

*verages for the United States of prices paid to producers of farm products.*

| Product | 1914 | 1913 | 1912 | 1911 | 1910 |
|---|---|---|---|---|---|
| | November 15 | | | | |
| | $ | $ | $ | $ | $ |
| ogs . . . . . .per 100 lbs | 7.00 | 7.33 | 7.05 | 5.86 | 7.61 |
| eef cattle . . . . » | 6.02 | 5.99 | 5.22 | 4.36 | 4.48 |
| al calves . . . . » | 7.74 | 7.70 | 6.77 | 6.10 | 6.39 |
| eep . . . . . » | 4.68 | 4.27 | 4.05 | 3.65 | 4.63 |
| mbs . . . . . » | 6.14 | 5.64 | 5.37 | 4.68 | 5.54 |
| ilch cows . . . . . per head | 58.77 | 57.71 | 47.38 | 42.70 | 43.34 |
| orses . . . . . » | 130.00 | 136.00 | 139.00 | 136.00 | 143.00 |
| ool unwashed . . . . .per lb | 0.181 | 0.156 | 0.186 | 0.156 | 0.179 |
| ool washed . . . . . » | 0.240 | 0.225 | 0.244 | 2.215 | 0.260 |
| ples . . . . . .per bu | 0.57 | 0.94 | 0.64 | 0.73 | 0.89 |
| ars . . . . . » | 0.78 | 0.93 | 0.79 | 0.85 | 1.01 |
| ans . . . . . .per bu | 2.28 | 2.20 | 2.25 | 2.34 | 2.14 |
| veet Potatoes . . . . . » | 0.72 | 0.73 | 0.74 | 0.76 | 0.69 |
| nions . . . . . » | 0.84 | 1.15 | 0.84 | 1.03 | 0.95 |
| bbages . . . . . .per 100 lbs | 1.14 | 1.58 | 1.04 | 1.51 | 1.36 |
| imothy hay . . . . . per ton | 13.69 | — | — | — | — |
| over hay . . . . . « | 12.70 | — | — | — | — |
| lfalfa hay . . . . . » | 9.20 | — | — | — | — |
| airie lay . . . . . » | 7.49 | — | — | — | — |
| over seed . . . . . .per bu | 8.02 | 7.33 | 9.06 | 10.37 | 7.70 |
| imothy seed . . . . . » | 2.34 | 2.08 | 1.82 | 6.90 | 4.08 |
| lfalfa seed . . . . . » | 7.29 | 6.36 | 8.23 | — | — |
| ttonseed . . . . . per ton | 14.01 | 22.46 | 18.57 | 16.69 | 25.36 |
| ops . . . . . .per lb | 0.156 | 0.260 | 0.197 | 0.414 | 0.294 |
| | December 1 | | | | |
| heat . . . . . .per bu | 0.986 | 0.799 | 0.760 | 0.874 | 0.883 |
| aize . . . . . » | 0.637 | 0.691 | 0.487 | 0.618 | 0.480 |
| ats . . . . . » | 0.438 | 0.392 | 0.319 | 0.450 | 0.344 |
| arley . . . . . « | 0.543 | 0.537 | 0.505 | 0.869 | 0.578 |
| ye . . . . . » | 0.865 | 0.634 | 0.663 | 0.832 | 0.715 |
| uckwheat . . . . . » | 0.764 | 0.755 | 0.661 | 0.726 | 0.661 |
| otatoes . . . . . » | 0.489 | 0.687 | 0.505 | 0.799 | 0.557 |
| axseed . . . . . » | 1.256 | 1.199 | 1.147 | 1.821 | 2.317 |
| ay . . . . . per ton | 11.12 | 12.43 | 11.79 | 14.64 | 12.26 |
| utter . . . . . per lb | 0.284 | 0.292 | 0.288 | 0.274 | 0.278 |
| gs . . . . . .per dz | 0.297 | 0.330 | 0.297 | 0.287 | 0.290 |
| uickens . . . . . .per lb | 0.113 | 0.114 | 0.108 | 0.096 | 0.106 |
| otton . . . . . » | 0.068 | 0.122 | 0.119 | 0.088 | 0.142 |

moderate one but the high prices prevailing make it the most valuable crop ever produced. The producers of wheat have benefited by very large production and high prices.

The apple crop of 1914 is probably the largest ever produced. in the United States, being estimated at 259 000 000 bushels as compared with 145 000 000 bushels in 1913. These figures represent the total agricultural crop and not the commercial crop, which comprises only the marketed portion of the total production. In 1913 the commercial crop was estimated at 40 % of the total agricultural production.

A tabulation of the average prices for the United States paid to farmers since 1910 is shown in the table on page 133.

104 – **Investigation into the Returns of Swiss Beekeeping in 1914** (Report of the Swiss Peasants' Secretariat) *Schweizerische Bienen-Zeitung*, Year XXXVIII, No. 11, pp. 428-435; No. 12, pp. 482-488. Aargau, Nov., Dec., 1915.

The Swiss Peasants' Secretariat publishes in this paper the statistical results of the accounts kept by the bee farms connected with the Secretariat which numbered 25 in 1911 and 1913 and 31 in 1914. The average production of honey per apiary and per hive during the three years is shown by the following table:

| Honey | Per apiary | | | Per hive | | |
|---|---|---|---|---|---|---|
| | 1912 | 1913 | 1914 | 1912 | 1913 | 1914 |
| | lb | lb | lb | lb | lb | lb |
| Collected . . . . . | 313.05 | 138.22 | 227.07 | 12.29 | 5.07 | 9.36 |
| Sold (1) . . . . . | 394.63 | 131.83 | 173.94 | 15.48 | 4.84 | 7.16 |
| Consumed by the household . . . . | 48.50 | 39.02 | 26.01 | 1.87 | 1.43 | 1.07 |

(1) Among the honey sold a certain quantity was in stock from the previous year, as some collected this year will be carried over to next year.

The 1914 yield was superior to the 1913 one, but inferior to that of 1912. Considering that a fairly good average should be about 17 1/2 lbs per hive, it will be seen that during the last few years the yield has not been satisfactory. The average sale price per pound of honey during the three years was 10 1/2 *d*, 1s 2 1/4 *d* and 1s 1 3/4 *d* respectively. According to the statistics of the Association of Swiss Beekeepers (1) the average yield for Switzerland was as follows:

| 1912 | 1913 | 1914 |
|---|---|---|
| Average of 688 apiaries | Average of 629 apiaries | Average of 736 apiaries |
| 11.96 lbs per hive | 9.04 lbs per hive | 8.38 lbs per hive |

(1) Verein Schweizerischen Bienenfreunde.

| | | Per apiary | | | | | | | | | Per hive | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1912 | | | 1913 | | | 1914 | | | 1912 | | 1913 | | 1914 | |
| | | £ | s | d | £ | s | d | £ | s | d | s | d | s | d | s | d |
| Gross returns | Honey | 14 | 3 | 1 | 7 | 17 | 10 | 12 | 18 | 6 | 11 | 1½ | 5 | 10 | 10 | 8 |
| | Hives etc. | 4 | 4 | 0½ | — | 6 | 4 | 2 | 7 | 7 | 3 | 3½ | — | 2½ | 1 | 11¾ |
| | Wax etc. | 1 | 3 | 0 | | 13 | 5¾ | | 9 | 6¼ | | 10¾ | | 5¾ | | 4½ |
| | Total | 19 | 10 | 1½ | 8 | 4 | 11¾ | 15 | 15 | 7¼ | 15 | 3¾ | 6 | 0¼ | 13 | 0¼ |
| Cost of production | Sugar | 6 | 3 | 8½ | 5 | 10 | 2½ | 5 | 14 | 2¼ | 4 | 10½ | 4 | 0¾ | 4 | 8½ |
| | General expenses | 4 | 6 | 5¼ | 3 | 16 | 11 | 3 | 17 | 8½ | 3 | 4½ | 2 | 10 | 3 | 2½ |
| | Labour | 5 | 18 | 1¾ | 4 | 7 | 2¾ | 4 | 8 | 0¼ | 4 | 7¾ | 3 | 2½ | 3 | 7½ |
| | Interest on capital | 4 | 19 | 11 | 4 | 13 | 6¾ | 4 | 7 | 2¾ | 3 | 11 | 3 | 5½ | 3 | 7 |
| | Total | 21 | 8 | 2½ | 18 | 7 | 11 | 18 | 7 | 1¾ | 16 | 9¾ | 13 | 6¾ | 15 | 1½ |
| Returns on capital and labour | | 9 | 0 | 0 | —1 | 1 | 10½ | 6 | 3 | 8½ | 7 | 0½ | — | 0 | 9¾ | 5 | 1¼ |
| Interest on capital in percentage | | | 3.10 | | — | 5.82 | | | 2.04 | | — | | — | | — | |
| Wages of labour per hour | | | | 6½ | — | 1 | 0½ | | 0 | 4 | — | | — | | — | |

NB. The wages of labour in the cost of production are calculated at 9 ½ *d* per hour. The interest on capital at 5 per cent.

On comparing these figures with those of the Swiss Peasants' Secretariat it will be seen that they agree only in 1912, whence it may be concluded that in order to generalise from the bookkeeping statistics relating to the results of beekeeping the number of apiaries that furnish accounts must be considerably increased.

The economic results of the last three years are summarized in the table on the preceding page.

## AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

105 – **The Autolysis of Grapes.** — PANTANELLI, E. in *Le Stazioni sperimentali agrarie italiane*, Vol. XLVIII, Part 10-11, pp. 783-821. Modena, 1915.

The writer has previously shown (1) that grapes physiologically mature or over-ripe contain a protease capable of dissolving part of the albumen.

When left exposed to the air the pulp of incompletely crushed mature fruit increases its autolytic power with respect to the albumen.

These observations suggested that autolysis of the albumen of the entire grape takes place after maturity, so that the must should be richer in the autolytic products in proportion to the ripeness of the grapes from which it was made.

This would account for the more rapid fermentation of must from well ripened grapes, since the alcoholic ferments prefer the more soluble autolytic products of albumen as a source of nitrogen.

The writer proposed the study of such questions and the determination under suitable conditions of preservation, of the possibility of obtaining an intramolecular respiration of the sugars by means of the exposure of the parenchymatous endocarp to a more or less slow death, giving rise to the formation of alcohol and without altering the structure of the cells. It is thus hoped to confirm the suspicion that during the first few hours at least after the extraction of the must, the alcoholic fermentation is begun by a zymase within the grape itself. *i. e.* that alcoholic fermentation may begin in the must before the intervention of the usual alcoholic ferments.

These researches carried out with sound grapes detached from the vines were designed to determine the following points :

*a*) autolysis of the proteins of normally matured grapes in aerobic and anaerobic conditions ;

*b*) decomposition of the plastic carbohydrates of mature grapes under aerobic and anaerobic conditions and researches on the alcohol content during this process ;

*c*) relation between the two processes.

The results of these investigations are summarised as follows : With regard to the digestion of the albumen : in grapes hung in the open air an auto-digestion of the albumen set in and then tended to be arrested ; in

(1) See *B.* May 1915. No 539. (*Ed*).

grapes hung in air containing chloroform digestion began more rapidly, then became restrained and finally more complete than in the case of grapes hung in free air, in spite of the accumulation of the products of digestion ; in grapes immersed in water containing 2 per thousand of chloroform : digestion was at first slow, then became more rapid owing to the diffusion of the products of digestion ; in grapes immersed in water containing 1 per thousand of formaldehyde, digestion began rapidly then slowed down or ceased, the secretion of nitrogenous products was greater in the beginning then diminished ; in grapes cut in half and their seeds removed, when kept in water saturated with thymol in the cold, autolysis was very limited in spite of the issue of soluble nitrogenous matter; besides the diffusion of nitrogenous matter from the grape which is rapid at first continues to diminish later.

With regard to the variation of the consumption of respiratory materials : in grapes hung in the air there was at first a consumption of acid and slight increase in the sugar, then a gradually increasing consumption of sugar; in grapes exposed to chloroform vapour, there was a gradually increasing consumption of sugar slightly more intense than in grapes hung in pure air; in grapes immersed in water containing chloroform there was a rapid and progressive loss of sugar, due mostly to diffusion and during the first period by intercellular alcoholic fermentation. The consumption was less complete than in grapes exposed to chloroform vapours. The acid was consumed only in the first phase, followed by a loss due to exosmosis which caused a rapid formation of acid; in grapes immersed in water containing formalin there was firstly a strong consumption of sugar without formation of alcohol followed by the formation of sugar (from the more complex carbohydrates) and consumption of more acid ; finally the consumption of sugar exceded slightly the synthesis; in grapes cut into two and immersed in water containing thymol, the strong consumption of sugar was accompanied in the first period by the formation of alcohol and the loss of acidity was due chiefly to consumption.

The diffusion of sugar already observed in grapes exposed to the vapours of chloroform (sample B) was strongest in whole grapes immersed in water containing chloroform (sample C) or with formalin (sample D) and in cut grapes of sample E) ; in sample B. growth was continuous; in sample C it was greatest at the beginning and then diminished in a certain relation with the law of diffusion; in samples D and E it increased to a maximum.

The diffusion of acid was generally much less than that of the sugar and increased in proportion to the progressive destruction of the cellular tissues.

The writer summarises the results of the observations and analyses as follows :

In grapes normally mature hung in the air or left to die slowly in an atmosphere of chloroform vapour, formalin or thymol in proportions hardly sufficient to impede the development of micro-organisms the digestion of albumen occurs with formation of soluble nitrogenous compounds, not precipitable with copper hydroxide. As this autodigestion also occurs in

the presence of chloroform and continues after the death of the tissues it may be considered due to the same cause which acts in the antiseptically preserved juice from well matured grapes. The progress of the autolysis of the protein varies according to the treatment of the grapes during preservation. The antolysis also affects the sugars the amount of which decreases more or less rapidly; only in grapes hung in free air is there a slight increase of sugar during the first days, followed by decomposition. The polysaccharides, soluble and insoluble hexosans easy of hydrolysis (excluding therefore cellulose), in fact all the plastic carbohydrates and the acids of cell sap are equally subject to the antolytic process.

The formation of alcohol in intercellular respiration of the sugar was observed only in grapes immersed in water and chloroform and in grapes cut into halves and immersed in water containing thymol. In both cases alcohol was formed only during the first days. In grapes hung in pure air or in the vapours of chloroform and in grapes immersed in water containing formalin no alcohol was formed notwithstanding greater or less decomposition of the sugars. Also in must or crushed grapes the formation of alcohol was never observed. The zymase of the grapes is therefore extremely sensible and perishes with the death of the cell. The possibility is also shown of alcoholic fermentation in the grape without the intervention of alcoholic ferments provided cells suffering from lack of oxygen be intact or only slightly narcotized.

A greater autodigestion of albumen occurred in the samples in which the destruction of sugar was greatest, as a rule the increase of proteolytic activity generally followed the period of maximum consumption of sugar.

There is reason to suppose that sugar may retard proteolysis and that proteases cannot act in grapes rich in sugar, but in reality autodigestion of the albumen occurs also in the first phase, thus supporting the more plausible opinion of DELEANO that in the presence of an abundance of sugar for respiratory purposes the protein is formed again, whilst after the disappearance of the greater part of the sugar the product of the hydrolysis of albumen become subject to respiratory oxidation so that the consumption of proteins always exceeds their reformation until the cell dies of exhaustion.

In grapes immersed in water containing chloroform, formaldehyde or thymol there was a strong diffusion of soluble nitrogenous substances, of sugar, acids, ether; the alcohol diffused immediately but the colloidal soluble proteins and carbohydrates, always remained in the grapes even many days after death. Also in the case of grapes hung in air the vapours of chloroform determined a secretion of sugars, acids and ethers.

The diffusion of the soluble nitrogenous compounds that is the digestion products of albumin did not always favour further digestion. The protein remaining in the fruit was either less digestible or certain substances useful to the proteolytic enzyme had left the tissues. The enzyme being insoluble in water and inseparably associated with the protoplasm was certainly unable to escape.

The loss of sugars and acids by diffusion did not always affect the consumption in respiration.

Chloroform had quite a different action accordingly as it acted as a narcotic or as a poison. In the first case it diminished the permeability to water of the cells of the pulp and epidermis, increased slightly the permeability to the various constituents of the cell sap; as a toxic agent it increased strongly the permeability to water and various substances.

Formalin, on the contrary, which acts simply as a poison, strongly diminished the permeability of the cells both for water and dissolved matter. The living cells, of the halved grapes after the first loss of substances due to cutting, re-acquired their normal permeability for water and soluble matter in their juice.

The phenomena described serve to explain the facts observed in various wine-making operations. During the transport of the whole or slightly crushed grapes a digestion of albumen occurs with increase in the soluble nitrogen compounds preferred by the alcoholic ferments. These grapes therefore ferment rapidly being rich in yeast cells. Well matured grapes owing to the natural concentration of the juice, and grapes kept for some time owing to autodigestion, ferment better than the same grapes less ripe or freshly gathered. This does not depend on the difference in sugar content since the yeast ferments equally well in must containing 15 or 20 per cent. of sugar, but on the more rapid growth of the ferment in the medium containing soluble nitrogenous products.

The must of grapes well matured or stored some time after harvest is also subject to bacterial fermentation for the same reason.

Grapes harvested without wilting undergo a rapid loss in their sugar content through respiration. Acids being also partly destroyed, grapes of high acidity become more suitable for winemaking whilst grapes of low acid content become less suitable.

*Conclusions*: In mature grapes harvested and preserved whole autodigestion of the albumin and destruction of the sugar and acids takes place to a limited extent if hung in air and to a large extent if immersed in water free from extraneous germs.

Under anaerobic conditions, entire ripe grapes form alcohol by intercellular respiration of the sugar without the intervention of alcohol ferments.

Mature grapes immersed in water loose their soluble constituents even though the tissues retain their vital functions and still more when death occurs, thus facilitating intracellular digestion of the albumin, insoluble carbohydrates, etc. There is a greater dissolution and separation of the substances suitable for use by the ferments, than that which occurs during the pressing.

106 – **The Effect of the Density of a Wheat upon its Flour Yield.** — LINDET, in *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. I, No. 21, pp. 632-640. Paris, November 33, 1915.

The object of these experiments, which were carried out at the mills of the "Assistance Publique" in Paris under the control of MM. Fleurent,

Arpin and Lindet, was to determine the variation in yield of different wheats in propotion to their density.

It is generally supposed that the grain of wheat containing the largest kernel in proportion to its envelope is the heaviest, and will consequently produce the largest amount of flour. The experiments in question show that estimation of the density from the bushel-weight is subject to much criticism. The bushel-weight of a wheat is the result of several factors, amongst which must be mentioned the size of the grains, their dryness, the thickness of their envelope, the presence in the interior of the grain of a certain amount of air, the presence of hollow grains, and the weight of the envelope. The determination of the real density of wheats by the classical flask method and in the presence of petroleum has given figures more in proportion to the amount of flour obtained. Nevertheless, this method is still attended by causes of error due to differences in thickness and dryness of the grain, etc.

More exact results are obtained by estimating the fibre, which is the chief component of the envelope, and the starch, which is present in the kernel but not in the envelope. This method, however, cannot be applied in the milling practice.

Since the determination of the density of wheat only gives approximate data, it is necessary to consider the question from the direct point of view of the flour yield. The term flour is to be applied, according to the International Congresses for the Suppression of Adulteration, "exclusively to the cleaned and industrially pure product obtained by grinding the kernel of the wheat grain." The controlled experiments show that:

1. It is not possible to obtain from all wheats the same amount of flour of the same quality.

2. The intensive work in cleaning the bran and remilling the offals, the improvement of the machinery, and the attention given to it, the care devoted to superintendence, etc., all falsify the estimation of yield.

3. Chemical and microscopic examinations of a flour do not allow of a determination of the degree of perfection at which it has been obtained.

The following table gives the analytic results upon which the conclusions of the writer are based:

| | Poulard Australian Wheat | Hard Winter Plate Wheats | |
|---|---|---|---|
| | | I | II |
| *Density of the grain.* | | | |
| Apparent density (weight of Imperial bushel . . | 62.25 lbs. | 62.25 lbs. | 58,85 lbs. |
| Actual density (flask method). . . . . | 1.58 | 1.55 | 1.44 |
| *Analyses of grain* (made by M. Lindet) | | | |
| Cellulose . . . . . per cent | 2.78 | 3.56 | 4.12 |
| Starch . . . . . per cent | 63.00 | 60.50 | 58.50 |

| | | Poulard Australian Wheat | Hard Winter Plate Wheats I | Hard Winter Plate Wheats II |
|---|---|---|---|---|
| *Milling results* (on 500 quintals, = 1800 bushels) | | | | |
| Flour | per cent | 75.70 | 74.08 | 70.65 |
| Bran | per cent | 20.10 | 21.09 | 22.03 |
| "Remoulages" (? Sharps) | per cent | 1.40 | 1.18 | 1.43 |
| "Bâtards" (? Middlings) | per cent | 3.10 | 2.71 | 3.27 |
| Siftings, dust, etc | per cent | 1.78 | 1.48 | 3.05 |
| | | 102.08(1) | 100.54(1) | 100.43 1 |

(1) The excess is due to the fact that these wheats, being considered too dry, were moistened, before milling. Otherwise the total would only have amounted to from 98 to 98.5 per cent. The envelope seems to absorb most of the water.

| | | | | |
|---|---|---|---|---|
| *Analyses of flours* (made by M. Arpin). | | | | |
| Moisture | per cent | 12.70 | 12.98 | 13.72 |
| Gluten | per cent | 11.34 | 10.17 | 11.13 |
| Fatty matter | per cent | 1.16 | 1.10 | 1.12 |
| Mineral substances | per cent | 0.51 | 0.50 | 0.68 |
| Fragments of cellulose | per cent | 0.34 | 0.37 | 0.42 |
| Acidity | per cent | 0.036 | 0. 038 | 0.061 |
| Quality of gluten | | very good | short, little elasticity | short, without elasticity |
| Amount of water absorbed by the gluten | per cent | 68.60 | 66.90 | 66.70 |
| *Analysis of offals* (made by M. Lindet). | | | | |
| "Remoulages" (? Sharps) Cellulose | per cent | 3.21 | 5.46 | 5.68 |
| "Remoulages" (? Sharps) Starch | per cent | 42.90 | 27.10 | 23.60 |
| "Bâtards" (? Middlings) Cellulose | per cent | 3.13 | 7.10 | 7.22 |
| "Bâtards" (? Middlings) Starch | per cent | 20.10 | 21.80 | 17.80 |

107 – **Value of Lime Seed as a By-product of the Lime Industry.** — TEMPANY, H. A. (Government Chemist and Superintendent of Agriculture for the Leeward Islands) Notes on the Feeding and Manurial Value of Lime Seed, in *West Indian Bulletin*, Vol. XV, No. 1, pp. 27-28. Barbados, 1915.

With a view to the possible utilisation of the surplus seeds of the lime fruit, enquiry was made into their manurial and feeding value and more especially into their oil content.

Analyses show that from the point of view of manurial constituents the material is less valuable than the majority of seeds: Nitrogen 1.11 per cent., Phosphoric acid 0.58 per cent., Potash 0.353 per cent., Moisture 9.30 per cent. As regards the feeding value the seed is deficient in protein but rich in carbohydrates. The most noteworthy feature of the results, however, lies in the high content of oil, amounting to 34.44 per cent.

About 200 gms. of lime seeds submitted to extraction with chloroform yielded about 35 cc. of rather dark yellow oil about the consistency of olive oil. The following constants were determined in respect of it.

| | |
|---|---|
| Specific Gravity $\frac{28.5°}{25.5}$ C | 0.9160 |
| Refractive Index | 1.4700 |
| Iodine Absorption | 153.9 (Hubl) |
| Saponification Equivalent | 339.6 |
| Solidifying Point | 6°-7° C |

The oil does not appear to possess any drying properties; a comparison with other oils appears to indicate that in general character it somewhat resembles the oils of the rape oil and cottonseed oil groups, and might find application as a lubricant or in soap making. When separated by means of solvents the oil possesses a very distinct bitter taste. Possibly if the oil were expressed by pressure the bitter flavour would not be so pronounced and it might then be used as a substitute for olive oil. On the other hand, the presence of such a bitter component in the press cake would no doubt impair the value of this for feeding purposes.

108 – **Zacaton as a Paper-making Material.** — BRAND, CH. J. and MERRIL, J. L. in *United States Department of Agriculture, Bureau of Plant Industry, Bulletin* No. 309. Washington, November 1915.

The Bureau of Plant Industry of the United States of America has published an account of the results so far obtained by the Paper-Plants Investigations (1) on "Zacatón" or American esparto as a raw material for the manufacture of paper.

Zacatón (*Epicampes macroura*) belongs to the tribe Agrostideae to which the true esparto (*Stipa tenacissima* L.) also belongs.

The genus *Epicampes* is exclusively American and *E. macroura* has been reported from many widely separated localities from Texas to Central America. Zacatón grows most profusely in the mountainous regions east and west of the City of Mexico and it is not uncommon to find areas many miles in extent covered by relatively pure stands of this grass.

The "raíz de zacatón" or zacatón root is the object of an extensive trade. Vera Cruz and Tampico are the chief exporting ports, while France, Germany and the United States are the chief users of the brushes into which the roots are manufactured. At present the tops are not used in any way.

The information that has been secured indicates the possibility of growing this grass successfully in some localities in the Southwest of the United States, especially for paper producing purposes. Allied species grow from Texas to California.

The experiments conducted by the writers at the Paper Plants Investigations Laboratory have shown that zacatón is an excellent raw material for the manufacture of paper. It can be chemically reduced to paper stock by the soda process under less drastic and less expensive conditions than those employed for the reductions of poplar wood.

The process, methods, and machinery employed for the manufacture of pulp from poplar wood are entirely suitable for the treatment of this material. A production of 43 per cent of air-dry fibre from the air-dry grass is regarded as a very good yield, the fibre yield from poplar wood being from 46 to 48 per cent and from esparto 43 per cent.

The chemical investigation of *Epicampes macroura* bleached pulp show it to be closely related to poplar pulp in chemical properties and considerably superior to the usual straw cellulose in power of resisting chemical attack.

(1) These investigations are conducted under the direction of CHARLES J. BRAND Chief of the Office of Markets and Rural Organization.

For bleaching the stock, however, it has been found necessary to use more bleaching powder than in the case of poplar stock.

Paper manufactured from this stock has shown physical tests equal to those of a first grade printing paper. It is realized that in these semi-commercial tests the maximum possibilities of this material in all probability have not been attained, and better results may reasonably be expected. From the work here described it would not be possible to make any estimate of the cost of manufacture or the value of the product. Such data can only be secured by extensive experimentation for a few months by an experienced mill organisation.

It is estimated than an acre of zacatón yields a ton of marketable roots and at least three tons of tops.



109 – **Influence of Temperature on the Proteolytic Activity of Lactic Ferments.** — GORINI, COSTANTINO in *Atti della R. Accademia dei Lincei*, Vol. XXIV, Part 8, pp. 369–376. Rome, October 17, 1915.

The writer has already pointed out the difference in the organoleptic properties of peptonized whey produced by the same lactic ferment according to the temperature at which it develops; this difference leads to the presumption of differences in the products of caseolysis.

The present investigations are a new analytic contribution to the demonstration already given by the writer as to the favourable influence exerted by low temperatures on the proteolytic activity of milk ferments. They further show that lactic ferments are to be especially studied in cultures kept at low temperatures. They increase still more the number of lacto-protteolytic ferments capable of peptonizing casein in an acid medium and prove that the *optimum* temperature is not the same for all the functions of a given micro-organism.

The proteolytic indices, collected by the writer in a table, show the possibility of verifying, also analytically, a difference which is not only quantitative but qualitative also in the proteolytic products of lactic ferments according to the temperature.

In the explanation of the greater caseolytic activity at low temperatures it must be considered that at this temperature the lactic ferments attack lactose more slowly, whence milk attains later than at high temperatures a degree of acidity capable of attenuating and stopping the development of the bacteria which thus can continue for a greater length of time to attack casein.

110 – **Experiments in Sweden on the Prolonged Pasteurisation of Milk.** — BARTHEL, CHR. (Central anstalten for forsöksväsendet pa jordbruksområdet, Bakteriologiska laboratoriet) in *Kungl. Landtbruks-Akademiens Handlingar och Tidskrift*, Year I,, No. 7; pp. 610-648 2 figs. Stockholm 1915 (Summary made by the author).

The object of pasteurising milk intended for direct consumption is two-fold. Firstly, pasteurisation destroys any pathogenic bacteria that may be present in the milk and, secondly,, pasteurised milk keeps for a longer period. The method of pasteurisation hitherto employed in the dairy industry consists in heating the milk by a continuous method in

which every particle of milk is exposed to a temperature of at least 176° F. for a relatively short period: from 1 to 1 ½ minutes.

This method of pasteurisation has, however a very unfavourable effect upon the general qualities of the milk. Thus, milk pasteurised at 176° F. has a slight cooked flavour even when cooled immediately afterwards. The cream rises less readily in pasteurised milk ; most of the albumen is coagulated and the lecithin is partially destroyed. The soluble phosphates are partially transformed into insoluble tricalcic phosphate ; the enzymes are destroyed etc.

Another system of pasteurising milk intended for direct consumption has been practised for several years in America and also for some time in Germany. This system called in America, the " holder ", or " holding-process ", and in Germany, " Dauerpasteurisierung " consists in heating the milk in large vessels to a relatively low temperature (generally 145° F.) for a fairly long period (20 to 30 minutes). During heating, the milk is kept in continual motion, but in such a way as to prevent any formation of froth.

This method has been the subject of a series of experiments at the Bacteriological Laboratory of the Central Station of Agricultural Experiments at Experimentalfältet during the winter and spring of 1914-15. The results obtained are very satisfactory and may be regarded as conclusive, the tests having been carried out under the actual conditions obtaining in practice.

Thus it was proved that milk pasteurised for from 20 to 30 minutes at 145° F. has no " cooked " taste ; this latter however becomes noticeable at 149° F. The cream also rises as readily in milk pasteurised at 145° F. as with unheated milk, but at 149° it rises more slowly. Heating to 145° does not affect the albumen or the soluble phosphates, but here again, the influence of a temperature of 149° F. begins to make itself felt. The enzymes remain intact at 145° with the exception of amylase which is destroyed at a relatively low temperature.

As regards the bacteriological qualities of milk pasteurised for a period of 20 to 30 minutes at 145°, the experiments showed that pasteurised milk keeps from 1 to 2 days longer than ordinary milk, according to the temperature at which it is kept. The effect of pasteurisation in destroying bacteria is very satisfactory ; generally over 9.5 per cent of the micro-organisms in the milk are killed by the heating process. Experiments with the bacterial flora of pasteurised milk have shown that when the milk after being heated is reinfected by the ordinary lactic ferments (as always occurs when pasteurised milk has to pass over refrigerators, through pipes, etc. before being bottled) it becomes acid in the usual way, but naturally more slowly than unpasteurised milk. The bacteria flora is visibly the same for both milks.

The experiments on the hygiene value of milk pasteurised by the above methods, were directed to determining the resistance of tubercle bacilli, since these are the most resistant to heat of all the pathogenic micro-organisms present in milk. Use was therefore made of naturally infected milk, that is to say, milk from cows suffering from mammary tuberculosis.

This milk was diluted in the proportion of 1:100 with ordinary milk and ahen treated under practical conditions, that is to say pasteurised in the apparatus used in the experiments described above. Portions of heated and unheated milk were centrifugated, the cream and sediment mixed with a small quantity of the same milk and intramuscular injections were made into guinea-pigs with each of the two samples. The control animals were killed after 6 weeks, and those which had received injections of pasteurised milk at the end of 3 months. In all, 70 guinea-pigs were injected. The following table gives the results of these experiments.

| Temperature of pasteurisation | Duration of pasteurisation in minutes | | | | Control animals |
|---|---|---|---|---|---|
| | 10 | 20 | 30 | 45 | |
| 140° F | — — — | — — — | — — — | | + + |
| 141.8° » | | — — — | — — — | | + + + |
| 143.6° » | | — — | — — — | | + + + |
| 145.4° » | | — — — | — — — | | + + + |
| » » | | — — — | — — — | | + + + |
| » » | | | — — | | + + |
| » » | | | — — — | | + + + |
| » » | | | — — — | | + + + |
| » » | | | | — — | + + |
| » » | | | | — — | + + |

N. B. Each sign + or — represents one guinea pig. + denotes that the animal was infected with tuberculosis, — that it remained free from the disease.

From the above table it is seen that none of the guinea-pigs that had been injected with pasteurised milk were infected with tuberculosis, not even when the temperature during the pasteurisation process was as low as 140° F and the milk heated for only 10 minutes. All the control animals were attacked by tuberculosis in its general form. The results are thus quite positive and conclusive, and agree very well with those previously obtained by American scientists. (Theobald Smith, Russell and Hastings, Rosenau) in their laboratory experiments.

The conclusion is therefore justified that the prolonged pasteurisation of milk, as carried out in the dairying industry, *i. e.*, heating the milk for 20 to 30 minutes at 140° to 147.2° F. in apparatus maintaining it in continual motion, is quite sufficient to remove all danger of the conveyance of tuberculosis by means of milk.

If, further, account is taken of the fact that this method of pasteurisation has no appreciable effect upon the qualities of the milk from the point

of view of its nutritive value, it is evidently extremely desirable that all milk intended for direct consumption, and which is not definitely known to come from non-tuberculous cows, should be subjected to a process of pasteurisation similar to the one described above.

In this way the difficult problem of supplying large towns with wholesome milk finds an easy and practical solution.

111 – **On a Biochemical Reaction of Rancid Fats.** — VINTILESCO, J. and POPESCO, ALIN, in *Journal de Pharmacie et de Chimie*, Year 107, Series 7, Part XII, No 10, pp. 318-323. Paris November 16,1915.

The writers have observed that fats of good quality become rancid after exposure to air and light without any increase in their acidity and therefore considered that, contrary to general opinion, fats are able to fix the oxygen of the air without having undergone previous hydrolysis, at any rate at the beginning of the change. It was further believed that this oxygen would be easily liberated by different agents and especially by peroxydases.

The experiments undertaken in this direction fully confirmed this hypothesis. With regard to the question as to whether or not fats contain oxydases, no oxidising ferments were found in any of the fats examined (lard, butter, olive and almond oils) either when fresh or after having turned rancid from exposure to the atmosphere. An attempt was then made to ascertain whether, on exposure to air, the fats really fix the oxygen capable of being liberated by the peroxidases. The technique followed by the writers is founded on the common method for the detection of blood in stains, urine etc. with the substitution of the fat for the hydrogen peroxide — as follows :

About 10 gr. of fat are placed in a test-tube (butter and lard are gently warmed to about 35° C. until completely melted) ; after adding 4 to 5 drops of dilute blood or of hœmoglobin solution 10 drops of tincture of guaiacum and about 10 cc. of distilled water, the test tube is corked and thoroughly well shaken for the space of 1 minute. When non- rancid fats free from disagreeable odour are used, the colour of the mixture remains unchanged, but if the fats are rancid the emulsion turns to blue, the depth of colour varying according to the degree of oxidation. In order to bring out the blue colour, especially in the case of slightly rancid fats, it is necessary to add to the mixture, after shaking it, an equal volume of 95 per cent. alcohol, this dissolves the oxidation product and makes the colour more apparent.

All the marketable fats gave this reaction, but not all to the same extent. The acidity of oils does not interfere with the reaction, because when neutralised with soda and subsequently washed with water and alcohol they give the guaiacum reaction with the same intensity as before neutralisation.

The experiments thus seem to prove that fats on exposure to air fix oxygen which can afterwards be liberated by peroxidases. The guaiacum reaction reveals the presence of this oxygen and affords a means of estimating the degree of rancidity.

12 – **Australasia's Wool Clip.** — *Dalgety's Review*, Year XXIII, No. 6, p. 122, Sydney, September 1, 1915.

The past clip was composed of 61 per cent. merino and 39 per cent. crossbred. The clip of 1913-14 was 69 per cent. merino and 31 per cent. crossbred. A few years previously, in 1910-11, the clip was 74 per cent. merino and 26 per cent crossbred. However, as the 200 000 bales of Australian wool on hand and unsold at June 30th, is composed almost entirely of merino wool, the proportion of crossbred wool actually produced in Australasia during the past year was about 34.3 per cent.

The total quantity of lambs' wool sold in Australasia during the year amounted to 74 797 bales, or 5 per cent. of the total wool sold. In 1913-14 the quantity of lambs' wool sold was 105 863 bales, and in 1912-13 the quantity was 65 106 bales. In the 1911-12 season, 93 050 bales, and 1909-10 108 808 bales of lambs' wool were sold in these markets.

It is rather remarkable that the proportion of lambs' wool to sheep's wool sold was the same during the past year as in 1913-14.

The average proportion of lambs to fleece dealt with during the past eleven years has been 5.36 per cent.

The quantity of scoured wool sold in Australasian markets was 87 103 bales, or 6 per cent. of the total wool sold, which compares with 172 729 bales, or 9 per cent. in 1913-14; 149 611 bales, or 8 per cent. in 1912-13; 144 046 bales, or 7 per cent. in 1911-12; 160 326 bales, or 9 per cent in 1910-11; 195 241 bales, or 10 per cent. in 1909-10; and 177 877 bales, or 11 per cent. in 1908-9.

The average proportion of scoured wool sold in Australasia during the past eleven years is 9,27 per cent.

13 – **The Chemical Composition of Hungarian Honey.** — (Publication of the Royal Hungarian Station of Biology and Animal Nutrition, Budapest) WEISER, ETIENNE in *Kisérletugyi Közlemények*, Vol. XVIII, No. 2, pp. 334-365. Budapest, 1915.

Notwithstanding the development of apiculture in Hungary a complete and systematic analysis of the honey produced in that country has not yet been made. It is, however, very important to know this in order to be able to tell in what way the Hungarian products differ from foreign honey, to what extent the analytic data obtained abroad are applicable to Hungarian honey and whether the various types of Hungarian honey are pure or adulterated.

The writer examined, in 1914, 37 samples of pure honey of different qualities, supplied by the most celebrated beekeepers of the country. The 37 samples included: 12 of honey made from *Robinia pseudo-acacia*, 11 from mixed flowers; 1 from fruit trees; 2 from lime blossom; 5 from *Stachys annua*; 2 from rape; 1 from *Ailanthus*; 1 from *Cirsium arvense* and 2 from Common Sainfoin (*Onobrychis sativa*). In addition to these pure kinds of honey, the writer analysed 1 sample of sugar honey and 1 of artificial honey.

The analytic results may be summarised as follows:

The water content of the samples analysed varies from 14.88 to 20.75 per cent. Average content 17.28 per cent.

The figures obtained for the invert sugar agree perfectly with the data found in apicultural literature: minimum 68.11 per cent ; maximum 79.04 per cent ; average 74.14 per cent.

The saccharose content of most of the samples was very low : minimum 0.04 per cent, maximum 8.60 per cent, average 3.92 per cent.

All the samples of honey were levorotatory — The non saccharine matter varied from 1.69 to 9.58 per cent with an average of 4.66 per cent.

The acidity was generally low : being equivalent to 0.12 to 2.25 mg. of potash per 100 grams.

It is interesting to note that the ash percentage in robinia honey was usually below 0.1 per cent. FIEHE also found the ash percentage below 0.1 in honey made from Leguminosae (robinia, clover, and sainfoin). The sainfoin honey examined by the writer also contained a very small amount of ash : 0.058 and 0.052 per cent. As a general rule the ash content of honey made from the nectar of flowers exceeded 0.1 per cent.

The crude protein content was very low and varied from 0.084 to 0.393 per cent.

The oxymethylfurfurol reaction was negative in the case of 36 samples of pure honey; only a sample (of 12 year old robinia honey) showed a positive reaction with resorcin hydrochloride. This honey had been exposed during storage to temperatures as high as 104° F. Experiments were made for the purpose of determining whether the positive reaction to FIEHE's test was due to this circumstance.

With the exception of the two samples of honey, all the samples of pure honey contained unweakened diastasic ferments. With FIEHE's and BECKMANN's reactions, not one of the samples gave any sign of the presence of dextrin. The saccharose content of sugar honey was only 2.05 per cent.

In connection with the results obtained, the writer gives lists of the plants visited by bees and of the different qualities of honey made in Hungary. The appendix gives statistical tables for the years 1909 to 1913 showing the great economic importance of the Hungarian honey industry.

AGRICULTURAL PRODUCTS : PRESERVING, PACKING, TRANSPORT, TRADE

114 – **Laboratory Research in Connection with the Grain Elevators of the Russian State Bank.** — SIDORENKO, K.; SKVORZOV, N. T., and POPOV, S. M. in *Selskoie Chosiaistvo i Liesovodstovo* (Rural and Forest Economy), No. CCXLVIII, pp. 581-607. Petrograd, August 1915.

Russia is at the present time engaged in the formation of a network of grain elevators the management of which presents considerable difficulties. In order to deal with these problems more effectively and to assist in a more rational organisation of the grain trade, laboratories for the inspection of the grain have been established in connection with the elevators. At the head of these laboratories are inspectors whose duty it is to analyse and classify the grain entering the elevators. On the basis of the inspectors' results the working of the elevators is controlled. In addition to these local laboratories which are necessarily of a utilitarian and practical nature, a central laboratory was instituted for scientific purposes such as the perfectioning of the methods and apparatus in use in the local laboratories.

Assuming that classification of the grain is the basis of the rational management of the elevators, the determination of the humidity which is the principal characteristic of the grain, was first investigated by the laboratory since the methods and results of this determination are incompletely described in the literature on the subject.

Hoffmann's method now largely employed for this purpose, was

investigated. This method consists in heating the grain in mineral oil in a metal vessel, the oil being used to prevent charring of the grain, To promote a better evaporation and more complete separation of the water, neutral substances are added such as toluol or, as suggested by GOLOUTCHENKO, a mixture of toluol and turpentine. In addition to this modification which effected a considerable reduction in the expense of the analysis, the same author also devised an apparatus for the determination of the humidity. Comparison of the two methods showed considerable differences between the results of a single determination by the Hoffman method whilst with Goloutchenko's method under the same conditions the greatest difference between a single determination by this apparatus and that of the desiccation method did not exceed 0.6 per cent. in the worst cases and was generally much less.

The effect of the substitution of turpentine for toluol and the mixture of these two substances on the accuracy of the results was also investigated and good results were obtained.

In addition to the determination of the general conditions for obtaining more accurate results with Goloutchenko's apparatus the laboratory has also devised standards for the determination of the humidity of the seeds of various plants not previously recorded.

Taking into account the working conditions of the elevators, the laboratory wished to make the use of the apparatus more uniform and with this object in view varied only the weight of the sample and the duration of the second period, *i.e.*, the time of heating the grains to 180° ; this being required by the difference in quality of the grains of various plants.

Thus, under the following conditions : period I, 8 minutes ; period II, 4-5 minutes ; volume of oil, 200 cc ; volume of mixture of toluol and turpentine, 10-50 cc.; temperature of heating grains, 180°, the laboratory has fixed the following standards for the determination of the humidity of the seeds of various plants :

| Seed. | Wt. of Sample. | Duration of Period II. After Hoffmann. | Laboratory determination. |
|---|---|---|---|
| Oats | 100 | 4 mins | 4 mins |
| Wheat | 100 | 4-5 » | 4-5 » |
| Rye | 100 | 3-4 » | 4 » |
| Hemp | 50 | no data. | 4 » |
| Millet | 100 | | 8 » |
| Buck wheat | 50 | | 7 » |

Thus, Hoffman's method may be considered to be completely elaborated by these experiments.

15 – **Potato Ensilage.** — See No. 83 above.

# PLANT DISEASES

## GENERAL INFORMATION

LEGISLATIVE AND ADMINISTRATIVE MEASURES FOR THE PROTECTION OF CROPS

116 – **Necessity of Legislation against the Coconut Bud-Rot in Cuba.**(1) — JOHNSON, JOHN, R. in *Modern Cuba, Cuba Moderna*, Vol. 3 (7) No. 3, pp. 76-80 (in English and Spanish). Havana, Cuba, March, 1915.

The progress of the bud-rot disease in Cuba has in the last few years reduced the annual exportation of coconuts from 25 million nuts to less than 7 million. Young and old coconut trees are dying throughout the Island.

To stimulate interest in the question the Government some years ago offered a prize to the person discovering the cause of the disease and a remedy for it. Up to date some sixty people have claimed the reward, but none have furnished proofs of the efficacy of the remedies proposed.

From the researches made some years ago (2), the writer concludes that the chances of finding a direct remedy are very small. In all the British West Indies the people have persisted in looking for a means of control, if not of cure, and have adopted measures that have reduced the loss to a minimum.

The writer draws attention to the efficacy of Law 35 in Jamaica, passed in 1911 (3). Under this law diseased coconut trees are destroyed, and thus the spread of infection is prevented. As a result of this, Jamaica still has a thriving coconut industry.

In Trinidad — where Law 38 of 1911 against the diseases of plants is in force (4) — the campaign is carried on with equal energy. In the first part of the campaign over 10 000 diseased trees were cut down. Information received by the writer from that Island, in 1914 confirms the efficacy of the destructive method. The smaller islands of the British West Indies have similar laws.

The writer concludes that the coconut bud-rot is an infectious disease and may pass from one plantation to another; it is therefore a public nuisance, and plants affected with it in Cuba should be subject to legislative control.

(1) See *B.* Dec. 1910, p. 369; *B.* July 1911, No. 2163; *B* Aug.-Sept-Oct. 1911, No. 2692; *B.* March 1912, No. 598; *B.* May 1912, No. 847; *B.* Dec. 1912, Nos 1686 and 1698; *B.* Jan. 1913, No. 40; *B.* May 1913, No. 609; *B.* Oct. 1914, No. 961. (*Ed.*).

(2) See *B.* Dec. 1912, No. 1686. (*Ed.*).

(3) See *B.* Nov.-Dec. 1911, No. 3279. (*Ed.*).

(4) See *B.* May 1912, No. 847. (*Ed.*).

## DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

117 – **New Disease of Beets, probably of a Physiological Nature, in the North of France.** — MIÈGE, EM., in *La Vie Agricole et Rurale*, Year 5, No. 19, p. 341, 1 fig. Paris 1915.

In 1915 a disease hitherto unknown to the growers appeared in nearly all the crops of sugar-beets and mangels in the North of France, no matter what were the cultural conditions. The writer noted it in most of the districts of the departments of Pas-de-Calais, Somme, Oise, Marne, etc., and in the neighbourhoods of Arras (where it appeared in the second half of June), Bethune, Doullens, Montdidier, Compiègne, etc. Practically all the fields could be considered affected, the maximum intensity being reached about Longueil-Sainte Marie, Verberie, etc. ; the attacks were much less frequent and of a milder form in the districts of the Marne and especially of the Meuse during August.

This disease, which seems to check the growth of the plants, presents the following symptoms. The leaves show a system of orange spots, which start from the edge and spread over the whole surface. Other diseases appear successively on the infected parts, which gradually wither and die, and the leaf then shrivels up and falls. The spots leave spaces with green parenchyma between them, but they affect the whole thickness of the blade ; the petiole and root appear to remain untouched. The leaves also show irregular swellings, chiefly in the centre along the midrib, which draw together giving to the whole a blistered appearance ; some of the leaves thus swollen may remain quite green. The yellow colouring of the spots is quite different from that of chlorosis, being more of an orange shade like rust ; the older leaves are the first to be attacked. The whole plant appears to suffer and its growth is more or less checked.

Microscopic examination of some diseased leaves made has not revealed any trace of a specific parasite, and the appearance of this condition under the most varied conditions suggests that it is due to physiological causes.

M. ARNAUD, of the Station of Vegetable Pathology in Paris, after examining some samples, believes it may be a case of yellowing due to defects in nutrition.

Reports on the weight and sugar-content of affected crops were not to hand at the time of writing.

118 – **On the "Breakage" (Cassure) of Tulips.** — HAMMARLUND, CARL in *K. Landtbrucks-akademiens Handlingar och Tidskrift*, Year 4, Part 2, pp. 89-109. Stockholm, 1915.

Gardeners have suffered much loss these last years in the forcing of tulip bulbs during the winter, from a disease of the plant generally known as "breakage". — Double varieties, especially the "Murillo" very commonly used for forcing, seem most liable to the infection.

The disease generally appears at the time when the buds are ready to open. The stalk just above the lower leaf assumes a transparent glassy aspect, this rapidly spreads and may in a few hours reach the next leaf; sometimes even the disease appears under the lowest leaf and spreads beyond the next one. The stem soon leans over and bends at the diseased spot, the flower bows down and is no longer saleable.

The disease has been mentioned in Germany by several authors, who call it "Unfallen der Tulpen", and also in Holland. Different opinions are held as to its causes.

It has been attributed to a parasite which weakens the tissue at the spot attacked. RITZEMA BOS believes it to be due to a parasitic fungus — *Botritis parasitica* Cav. — which attacks the tissues of the plant. KLEBAHN holds *Sclerotium Tuliparum*, which according to J. H. WAKKER is identical to *Peziza bulborum*, to be the cause of the injury. On the other hand P. SORAUER considers the cause of the disease to be entirely different; he believes that at a high temperature the plant grows so rapidly that it cannot succeed in forming the quantity of amylolytic enzyme necessary to its perfect development with the result that the cells do not receive enough hydrocarbon during their growth and that the cellular tissues being weakened lack the strength to support the weight of the flower.

In the course of his studies on the "breakage" of tulips, the writer ascertained that the softened tissue contained abundant bacteria at the spot where the stem had bent and concluded at first that these had caused the disease. He then proceeded to infect healthy tulips with these bacteria: 1) by putting moist portions of infected plants containing bacteria on the stalk at the origin of the leaf under the diseased place; 2) by injecting a culture of bacteria into the stalks of young tulips. In the majority of cases the result was negative. In one case the stalk bent, but the bacteria found in the cells at the spot where the "breakage" occurred were so scarce that they could not have caused a perceptible weakening of the cellular tissues. On the other hand, *B. parasitica* had reached such a development on this tissue that it appeared to be the possible cause of the disease. This fungus is found pretty frequently on tulips, especially when the soil is damp, but itdoes not cause any disease. Several tests by injections of *B. parasitica* have been generally successful but have never caused the disease in question.

As parasitical infection did not seem to be the cause of the disease, the writer undertook several series of tests in order to discover whether it might depend upon external conditions influencing the intensity of growth, as for instance heat and moisture during forcing. It was thus clearly proved that high temperature did not cause the disease of "breakage" as SORAUER asserted, for even at a temperature of 26-28° C. no "breakage" occurred, save in the case where the degree of moisture in the air was very high. "Breakage" occurred, on the contrary, even when the forcing took place at a temperature as low as 8 to 10° C. if the relative moisture of the air was as high as 89%. The deterioration of the plant progressed rapidly as soon as the cellular tissue began to be transparent but did not wither.

The writer accounts for the disease in the following manner : the high degree of moisture hinders transpiration; the stomata are obstructed by liquid water which hinders the plant from breathing carbonic dioxide and this causes a lack of the *materia prima* for the formation of cellulose – especially when the high temperature stimulates the formation of cells ; — the cellular membranes become weak and the excessive turgescence causes the rupture of the parenchyma. The contents of the cells are then forced into the intercellular spaces and the tissue becomes transparent. The fact of the disease occurring above the lowest leaf is due to the growth being greater at that spot and at the same time to the weight of the flower above which causes it to bend.

As a prophylactic measure against "breakage", the writer recommends planting the bulbs to be forced wider apart, tempering the moisture by moderate watering and by ventilating the space in which forcing takes place.

## DISEASES DUE TO BACTERIA, FUNGI AND OTHER LOWER PLANTS.

GENERALITIES

119 – **On the Perennial Mycelium in Species of Peronosporaceae.** — MELHUS. F. E. in *Journal of Agricultural Research*, Vol. V, No. 2, pp. 59-71, fig. I, plate III. Washington, D. C., 1915.

The present research has served to determine numerous species of Peronosporaceae which are perennial in the tissues of their hosts, the mycelium passing the winter either in the aerial or the underground organs of winter annuals, biennials or perennials.

The rôle of the mycelium of *Phytophthora infestans* in the tubers of the host is not an unusual one. It may grow from the tubers up the stem to the surface of the soil, sporulate and cause foliage infection and bring about an epidemic of the disease. A list of the species of Peronosporaceae which have perennial mycelia and of their respective host plants is given below :

*Phytophthora infestans* on *Solanum tuberosum ; Ph. cactorum* on *Panax quinquefolium ; Cystopus candidus* on *Capsella bursa-pastoris* and *Lepidium virginicum ; Plasmopara viticola* on *Vitis vinifera ; Pl. pygmaea* on *Hepatica acutiloba ; Pl. halstedii* on *Helianthus diversicatus ; Peronospora dipsaci* on *Dipsacus fullonum ; Per. schachtii* on *Beta vulgaris ; Per. alsinearum* on *Stellaria media; Per. grisea* on *Veronica hederaefolia; Per. effusa* on *Spinacia oleracea* and *Atriplex hortensis ; Per. ficariae* on *Ranunculus ficaria* and *R. fasciculatis ; Per. parasitica* on *Lepidium virginicum ; Per. viciae* in *Vicia sepium ; Per. rumicis* on *Rumex acetosa.*

DISEASES OF VARIOUS CROPS

120 – **Hibernation of *Phytophthora infestans* in the Fresh Potato.** — MELHUS, F. E. in *Journal of Agricultural Research*. Vol. V, No. 2, pp. 71-102, figs. 1-3 plates IV-VIII. Washington, D. C., 1915.

It is clear from the author's experiments that the mycelium of *Phytophthora infestans* spreads in the tissues of the potato tuber and finally reaches the sprouts. The growth of the fungus is retarded when diseased

tubers are held in dry soil or at temperatures below 5° C. Infected tubers rot rapidly when placed in warm wet soil. A temperature of 23° to 27° C. and a well watered soil are found to be most favourable for the mycelium to spread in the tuber and grow out into the sprouts, both when partially and when wholly covered with soil. Under these conditions the sprouts may become infected from 4 to 20 days after planting, regardless of their size and age. The time required is doubtless influenced by the proximity of the mycelium to the buds, and by external conditions. The mycelium of *Ph. infestans* may remain alive in seed tubers planted in the soil for at least 45 days and even longer if soft rot has not deteriorated or destroyed the tissues.

Contrary to what MASSEE has stated, the author absolutely denies the *latent* existence of the potato fungus in the stems and leaves of plants growing from diseased tubers.

Laboratory tests show that the mycelium is capable of reaching the aerial portions of the plant where it develops and sporulates causing foliage infection. Infected potato tubers used for seed purposes and planted under field conditions may cause the development of an epidemic. Ten such cases were found and followed in Northern Maine during the growing seasons of 1913 and 1914. Conidia of *P. infestans* may be borne on cut surfaces and on sprouts when planted under field conditions. As the cut surface corks over or the tuber decays, the fructification of the fungus decreases. Spores taken from tubers two or three weeks after they were first planted, showed only limited germinating capacity.

No evidence was obtained tending to show that the conidia borne in the soil are instrumental in starting foliage infection.

121 - ***Phytophthora infestans, Alternaria solani*** **and** ***Actinomyces chromogenus*** **on Potatoes in Cuba.** — JEHLE, R. A. in *Modern Cuba*, Vol. 3 (7), No. 4, pp. 46-48 (in English and Spanish). Havana, Cuba, 1516.

The occurrence of *Phytophthora infestans* has been noticed on several farms in the vicinity of Santiago de las Vegas and at Artemisa. This fungus is prevalent in the vicinity of Güines, where the potatoes were usually blighted before they reached maturity, the disease causing a partial or total failure of the crop.

In the United States the parasite does not usually do much damage until the blossoming stage, but in Cuba plants only three to six inches high were observed to be attacked severely.

On the leaves, *Alternaria solani* (= *Macrosporium solani*), was also observed but was not nearly so prevalent as *Phytophthora*.

The writer recommends spraying the plants, when a few inches high, with Bordeaux mixture at intervals of a week to ten days, or oftener if necessary, the period between spraying depending upon weather conditions and rapidity of growth. If such means, which in experiments made at Cuba have given good results, were adopted, the potato crop of the island could be increased from 40 to 80 per cent. and the danger from the rotting of tubers in transit and storage would be reduced to a minimum. The potato plants could be brought to maturity and it is possible that the

growers could use their own tubers for seed instead of being obliged to import them.

One patch of potatoes was found to be seriously attacked by *Actinomyces chromogenus*. To prevent this disease, the tubers for planting should be treated before being cut, by immersing for two or more hours in a solution of 1 ounce formalin to 2 gallons water, or in a solution of bichloride of mercury consisting of 1 ounce to 8 gallons water. If possible, fields in which scab is very abundant should not be used for potatoes for several years as the fungus lives over from season to season in the soil.

122 – **Bacterial Rot of Stored Potato Tubers.** — HUTCHINSON, C. M. and JOSHI, N. J. in *Memoirs of the Department of Agriculture in India, Bacteriological Series*, Vol. I, No. 5, pp. 113-135, plates I-V. Calcutta, 1915.

A description of four species of bacteria which are directly causative of rotting of potatoes, especially in storage and are responsible for the rapid deterioration and even the complete destruction of entire crops of tubers. This rot has been recorded in different and widely separated parts of India (Poona, Cawnpore, Sabour, [Bihar], Shillong, Orissa).

The infected tubers received showed, in the first stage, minute black specks on the outside surface, the tuber being found sound inside. In later stages these black marks extended through the skin to the flesh to varying depths. The most advanced stage was marked by large discoloured patches of loose skin, covering cavities containing gas; in some cases greyish white frothy matter oozed out from these discoloured patches.

The examination of the infected tissues led to the discovery of bacteria of varying morphological characters. Bacterial cultures were made by the authors who succeeded in isolating the organisms capable of producing the rot. These may be divided into four groups:

I) Motile. Peritrichic flagella: 0.5 μ × 1.2 to 1.6μ. Optimum temperature 30° C.; thermal death point 54° C. Besides the inoculations into raw potatoes, which gave definite results, inoculations were also made into: *Suthni* (*Dioscorea* sp.); *Arva* (*Colocasia antiquorum*); Sweet Potato (*Ipomea Batatas*); Onions (*Allium Cepa*); and Carrots (*Daucus Carota*). Inoculations were successful in *Suthni* and sweet potato after a long time. This organism may be considered an example of variation of *B. coli*, such variation consisting in the loss of proteolytic power, this probably being due to the carbohydrate character of its habitual pabulum.

II) Non-motile. No flagella: 0.8 μ to 1.0 μ × 1.6 μ to 2.0 μ. It has not been possible to determine an optimum temperature: grows well from 20° to 35° C. Thermal death point 57.5° C. The bactericide action of direct sunlight was as follows

*Exposed to direct sun:*

| | | | |
|---|---|---|---|
| 5 | minutes | No | appreciable effect |
| 10 | » | 10 % | organisms killed |
| 15 | » | 30 % | » » |
| 30 | » | 90 % | » » |
| 60 | » | 100 % | » » |

Inoculations of tubers gave positive results after three or four hours.

III) Slimy white organism. Non-motile. No flagella : 1.6 μ × 1.0 to 1.2 μ ; occurs in short chains of 2 to 4. Grows well at temperatures from 20° C. to 35° C. Thermal death point 59° C.

IV) Motile. 1.4μ to 1.8 μ × 0.4μ to 0.5μ, 1 or 2 flagella at one pole. Optimum temperature 37° C., thermal death point 59.5° C. This organism agrees entirely with *B. xanthochlorum* Schüster.

The authors carried out some interesting exeriments in order to determine in what manner the entry of the bacteria to the tubers was effected and the infection of the tissues propagated. Sound tubers were externally sterilized. They were divided into two lots A and B. Those in A were punctured with a sterile needle, Both lots were kept in contact with rotting tubers ; part were kept dry ($B_1A_1$) and part were kept moist ($A_2B_2$). After 24 hours the following results were noted :

B. Unpunctured . . { $B_1$ (Dry). Remained sound. / $B_2$ (Moist). Rotted. (Slime and gas).

A. Punctured. . . . { $A_1$ (Dry). Rotted. / $A_2$ (Moist). Rotted. (Slime and gas).

Moisture and mechanical injury thus appear to be the principal predisposing causes of this rot. As regards remedial and preservative measures the authors make the following recommendations :

1) Great care must be taken to avoid mechanical injury to tubers while digging and in handling them in transit to storage.

2) Sand or any other material used for storing must be thoroughly dried before use ; sandy soil must not be substituted for sand, and this latter should be the coarsest procurable.

3) Disinfection of the tubers at least once by treatment with 2% copper sulphate solution.

123 - **Species of the Genus *Rhizoctonia* Injurious to Plants Cultivated in India.** — Ajrekar, S. L. and Shaw, F. J. F. in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. VII, No. 4, pp. 177-194, plates I-VI. Calcutta, 1915.

Two species of *Rhizoctonia* (*R. napi* West. and *R. destruens* Tassi) which cause considerable havoc among plants in different parts of India, present in their development some points of general scientific interest.

*R. napi*, besides causing damage to mustard, spreads also to other plants, amongst which are *Medicago lupulina, Pisum sativum, Vicia hirsuta*, etc. It was noticed for the first time in a mustard field at the Pusa Experimental Farm in January 1914. The pathological characters are in all cases similar : hyphae tightly woven together which develop into patches and strands of the epigeal portions of the plant, producing deep and extensive rot which attacks and destroys the tissues.

An examination of the sclerotia enveloped in the mycelium enabled this parasite to be identified as *R. napi* West., a fungus which was first discovered upon *Brassica napus* at Courtrai in Belgium. The perfect stage of *Rhyzoctonia* is, in some forms at least, a basidiomycete belonging to the

genus *Corticium*. The authors, howeder, have been able to observe in numerous cultures the presence of spores which by their form and position have no relation to *Corticium*, while on the other hand they strongly suggest the genus *Botrytis*: hyphae with short thick conidiophores, swollen at the base, collected in a dense bushy terminal growth at the apex of a thick hypha ; hyaline spores with a diameter varying from 4 to 8 and even 12μ. The growth of the fungus is much influenced by temperature: at 29° C. growth was already much weaker, and was practically entirely inhibited at 32° C. Growth was resumed when conditions became favourable again.

*R. destruens* was first noticed in July 1912, when it appeared on rotting stored potato tubers sent from storage. The diseased potatoes were rather soft and showed thick white strands of mycelium in patches with spherical sclerotia of a light brown colour, of fairly regular spherical shape about 1-2 mm. in diameter. Observations of the mycelium and sclerotia have undoubtedly proved this parasite to be identical with *R. destruens*, first described by Tassi on *Delphinium* in the Botanical Gardens at Siena in Italy.

Cultures obtained from infected portions inoculated into sound tubers gave decidedly positive results This fungus attacks in India not only potatoes but also betel vine (*Piper betle*), suran (*Amorphophallus campanulatus*) and other plants. The fungus attacks the plants at the collar, where the first patches of mycelium appear, these penetrate deep into the root system causing it to rot.

As means of prevention, rotation of crops (avoiding a *Rhizoctonia* susceptible host for a few seasons) and sterilizing of soil and seeds, is suggested. The sclerotia of *R. destruens* loose their germinating power after sixteen months; an efficient rotation may therefore retard and even prevent the development of the parasite and it might be worth while to conduct serious and extensive experiments on this line.

The sterilization of the soil may be effected either by watering with a weak solution of formalin, or by "rabbing", that is, burning the surface layers of the soil by igniting straw, rubbish or fire wood on the ground which is to be sown. Tubers and seeds may be treated with formalin, the proper strength being 0.5 per cent. or what is still better, with corrosive sublimate, 0.1 to 1,0 per cent., the action of which as a fungicide is undoubted.

The species of *Rhizoctonia* known in India are :

1) *R. napi* West. Sclerotia, large irregular bodies about 3 to 12 mm. broad, black on outside, flesh coloured in interior. This species should be removed from the genus *Rhizoctonia*, as it appears to be merely a synonym for *Botrytis*.

2) *R. destruens* Tassi. Sclerotia roughly spherical about 1 to 2 mm. in diameter, brown on outside, white within.

3) *R. solani* Kühn. Sclerotia small black bodies resembling perithecia of an ascomycete. *R. medicaginis* D. C. is almost certainly the same fungus.

4) *Rhizoctonia* sp. This form has *Corticium vagum* B. and C. as its perfect stage. The sclerotia are irregular structures 2 to 5 mm. in diameter,

dark brown colour both on exterior and within, the mycelium when old becomes of a reddish brown colour.

The following is a list of the principal host plants of *Rhizoctonia* in India :

1) *R. solani* on *Alysicarpus, Arachis hypogaea, Carica papaya, Citrullus vulgaris, Corchorus capsularis, Crotalaria juncea, Cucurbita maxima, Dolichos biflorus, D. lablab, Gossypium, Hibiscus cannabinus, Lycopersicum esculentum, Medicago sativa, Morus alba, Nicotiana tabacum, Phaseolus lunatus, Phaseolus mungo* var. *radiatus, Sesamum indicum, Solanum melongena, S. tuberosus* and *Vigna catjang.*

2) *R. destruens* on *A. hypogaea, Amorphophallus campanulatus, Delphinium, Dianthus, Medicago sativa, Piper betle, Solanum tuberosum.*

3) *R. napi* on *Amaranthus tristis, Argemone mexicana, Avena sativa, Beta bengalensis, Brassica campestris* var. *glauca, Calamintha, Cannabis sativa, Chenopodium album, Cicer arietinum, Cnicus arvensis, Fumaria parviflora, Hordeum vulgare, Lathyrus sativus, Lens esculenta, Leucas, Linum usitatissimum, Medicago lupulina, Pisum sativum, Scoparia dulcis, Triticum vulgare, Vicia hirsuta.*

4) *Corticium vagum* B and C. on *A. hypogaea, S. tuberosum, Trichosantes cucumerina, V. catjang.*

124 – ***Marasmius perniciosus* n. sp. Cause of "Witch Brooms" ("Krullotenziekte") on the Cocoa-tree in Surinam.** — STAHEL, GEROLD in *Department van den Landbouw in Suriname, Bulletin* No. 33, pp. 1-27 (Dutch text), pp. 1-27 (English text), pp. 1-26 (German text), pl. I-XII. Paramaribo, 1915.

In Surinam the formation of « witch brooms » on Cocoa-trees was first reported in the district of Saramacca in 1895, since then it has gradually spread throughout the whole Colony and even in the neighbouring districts of British Guiana.

By a series of researches the writer has been able to determine with accuracy the nature of this parasite which belongs to the genus *Marasmius* and is by him described as a new species under the name of *M. perniciosus.*

In culture the mycelium of the fungus develops quickly and abundantly presenting the clamp-connections of basidiomycetae.

Inoculation tests made with the mycelium gave entirely negative results, hence the necessity of further researches on the fruit bodies of the fungus. These are never found on green " brooms " but these appear regularly soon after decay has set in, especially during damp weather.

Examination of the fruit-bodies led to the determination of three different fungi: a small longstemmed white *Agaricus*; an orange-red *Laschia*, and finally a white *Marasmius.* The spores of the latter introduced into sound buds, produced the characteristic « brooms ». *M. perniciosus* has never been found on any plants but cacao trees, as, however, the fungus can live and fructify as a saprophyte, it may therefore possibly be found on the dead branches and trunks of other plants. It is however doubtful, since its development is so slow, that it would be able to resist successfully common saprophytes. When however the " witch broom " is the host it is quite different, as then the parasitic

hyphae of the mycelium penetrate the entire tissue, develop saprophytic side branches and at once fill up every decaying cell before other fungi can enter from without.

It cannot be affirmed that the formation of indurated pods (" veisteende vruchten ") on the Cocoa-tree is due to the same agent which produces the " brooms " for up to the present no inoculation experiments have been conpleted. Several facts speak however in favour of this hypothesis, amongst others :

1) Indurated pods as well as " brooms " are found only in Surinam and adjacent parts of Demerara;

2) Indurated pods and " brooms " are always found together;

3) The fungus both in the indurated pods and brooms spreads and ramifies in the intercellular spaces;

4) Examination of the mycelium isolated from indurated pods shows all the characters of *Marasmius* ; on fallen fruit, especially in the rainy season, fructifications of *M, perniciosus* are met with in large quantities.

The author intends carrying out further researches on the subject.

The introduction of an immune variety of cacao-tree would certainly constitute the best and most rational method of prevention but the results obtained until now at the Experimental Garden of Paramaribo have not been encouraging.

Even *Theobroma bicolor* and *Th. speciosum* which grow wild in the forests of Guiana and Brazil, are often badly attacked by *Marasmius*. Experiments are being carried on for studying the effect of a partial suppression of shade-trees, as it is known that " brooms " and indurated pods are much less frequent in plantations where there is little shade. In Surinam two systems of control are being conducted: by pollarding and by spraying with Bordeaux mixture. In the first case the chief branches are cut and the stumps watered with sulphate of copper : the hypertrophic infected tissues are thus eliminated at one blow. This method however causes the loss of the harvest for one or two years, which explains the increasing preference given to the use of Bordeaux mixture. The spraying should be done at the end of the dry season, that is either in October or November according to the locality, at the same time gathering the infected fruit and cutting off and burning the " brooms ".

## WEEDS AND PARASITIC FLOWERING PLANTS

25 – **Notes on Some South African Mistletoes and their Hosts.** — MARLOTH, RUDOLF and DRÈGE ISAAC LOUIS in *The South African Journal of Science*, Vol XI, No. 10, pp. 402-403, pl. 12. Cape Town, 1915.

The genus *Viscum* which comprises about sixty species in various parts of the world, is represented in Souh Africa by twelve species. Most of these are known to inhabit various hosts.

*V. capense* which is perhaps the most widely spread species occurs, among others, on several species of *Rhus, Royena, Euclea, Lycium, Acacia* and *Zyzyphus mucronata*, but also on several introduced trees, *e. g.*, the fig, pomegra-

nate, willow, poplar, etc. Equally indifferent with regard to the host is *V. rotundifolium.* noticed on *acacias, willows,* and *Larissa arduina* ; and *V. obscurum* which occurs on *Gymnosporia laurina, Lycium horridum* and *Euclea; V. crassulae,* besides occurring on its host plant *Crassula arborescens,* also occurs, as shown by M. Drège's specimens, on *Portulacaria afra, Euphorbia coerulescens* and *E. polygona.*

The most interesting species is *V. minimum,* originally discovered on succulent Euphorbias, but the species of the real host was not known until recently, when M. Drège identified it a few years ago near Port Elizabeth (Cape Colony) on *E. polycona* and, so far, it has not been noticed on any other host plant. *V. minimum* is in reality an internal parasite, for the strands of the thallus are completely embedded in the fleshy stem of the host, the flowering tips only perforating the epidermal tissue of the host and appearing on the surface. The tips of the strands are green and protrude only for 1 to 2 mm ; they generally bear two or three flowers, also only 2 to 3 mm. long.

The ripe fruit (pseudoberry) is bright scarlet, about 6 to 7 mm. in diameter, hence much larger than the visible portion of the plant. The mode of life of this flowering plant much resembles that of some parasitic fungi, *e. g. Plasmopara viticola,* the false mildew, and *Phythophtora infestans* the potato disease, which also spread within the tissue of the host during their vegetative period, sending the fructiferous organs only to the surface.

126 – **Parasitism of *Comandra umbellata.*** — HEDGCOCK, GEORGE GRANT (Pathologist, Investigations in Forest Pathology, Bureau of Plant Industry) in *Journal of Agricultural Research,* Vol. V, No. 3, pp. 133-135. Washington, October 18, 1915.

One of the most important and most injurious of the stem or blister rusts occurring on pines is *Peridermium pyriforme* Peck, which attacks *Pinus* (*murrayana*) *contorta* Loud., *P. ponderosa* Laws ; and *P. ponderosa scopulorum* Engelm, in the Western United States, *P. divaricata* Du Mont de Cours, in the Northern States, and *P. pungens* Michx. and *P. rigida* Mill. in the Northwestern States. *Peridermium pyriforme* is a heterœcious rust and is dependent for its existence upon its alternate, or summer, stage, which occurs on species of *Comandra.*

The problem of the eradication of this important rust being so intimately associated with plants of *Comandra* spp. led the writer to investigate their manner of growth and means of propagation. It was found that the plants of at least two species, *C. pallida* A. DC. and *C. umbellata* (L.) Nutt. have apparently become largely dependent on parasitism for their continued existence. The other two North American species, *C. livida* Richards, and *C. richardsiana* Fernald, resemble the former species in appearance and habit and are probably equally parasitic in their nature.

The writer has carefully examined the root system of living plants of both *C. umbellata* and *C. pallida,* but only of dried specimens of the other two species. The former have long underground rootstocks which bear here and there small roots or rootlets usually less than 5 inches in length. These rootlets branch sparsely and are nearly always attached to the roots or underground stems of other species of plants. At the point of attachment

there is formed by the root of *Comandra* spp. a nearly hemispherical disk or holdfast.

This holdfast is either superficial or slightly embedded in the cambium layer of tissues of the host, but does not send out haustoria, as is the case in species of Razoumofskya on the limbs and trunks of coniferous trees. The chief function of the roots of *Comandra* spp. appears to be that of attachment to host plants for the purpose of obtaining nourishment and a water supply. Plants of *Comandra* spp. frequent dry, rocky soils, which often have a low water content.

Plants of all these species of *Comandra* bear leaves ; and although attached as parasites to the roots of other plants, they are not entirely dependent upon their host plants for organic compounds, since they are able to elaborate these compounds further in the liquids received from their hosts. In this respect their development is similar to that of plants of species of *Phoradendron.*

Both *C. umbellata* and *C. pallida* very commonly are associated with and parasitic upon species of *Vaccinium*, but are not at all dependent upon this genus for host plants. This has especially been noted in the case of *C. pallida* in the States of Colorado, Montana, Nebraska, South Dakota, and Wyoming, and in *C. umbellata* in the States of Connecticut, Maryland, Michigan, Minnesota, New Jersey, New York, Pennsylvania, Vermont, Virginia and Wisconsin, and the District of Columbia. Plants of both species are parasitic upon a great variety of plants belonging to widely different sections of the Spermatophyta. No attachment to plants of any member of the Pteridophyta has been noted.

*C. umbellata* has been found by the writer as a parasite on the roots of the following species of plants in the Eastern States :

*Acer rubrum* L.
*Achillea millefolium* L.
*Andropogon virginicus* L.
*Angelica villosa* (Walt.) B. S. P.
*Antennaria plantaginifolia* (L.) Richardson.
*Aster crisoides* L.
*Aster macrophyllus* L.
*Aster patens* Ait.
*Aster undulatus* L.
*Baptisia tinctoria* (L.) Br.
*Betula nigra* L.
*Betula populifolia* Marsh.
*Carex* sp.
*Castanea dentata* (Marsh) Borks.
*Chimaphila umbellata* (L.) Nutt
*Chrysopsis mariana* (L.) Nutt
*Comptonia peregrina* (L.) Coulter
*Danthonia compressa* Austin
*Fragaria americana* (Porter) Britton.
*Fragaria virginiana* Duchesne.
*Gaylussacia frondosa* (L.) T. and G.
*Hieracium venosum* L.
*Ionactis linariifolius* (L.) Greene.
*Lespedeza violacea* (L.) Pers.
*Lysimachia quadrifolia* L.
*Meibomia paniculata* (L.) Kuntze.
*Panicum* sp.
*Poa compressa* L.
*Poa pratensis* L.
*Populus tremuloides* Michx.
*Potentilla monspeliensis* L.
*Quercus coccinea* Muenchh.
*Quercus digitata* (Marsh.) Sudw.
*Quercus marilandica* Munchh.
*Quercus nana* (Wood, Britton).
*Rhus copallina* L.
*Rosa blanda* Ait.
*Rosa canina* L.
*Rubus canadensis* L.
*Rubus procumbens* Muhl.
*Rubus villosus* Ait.
*Solidago bicolor* L.
*Solidago caesia* L.
*Solidago juncea* Ait.
*Solidago memoralis* Ait.
*Solidago speciosa* Nutt.
*Spiraea salicifolia* L.
*Vaccinium atrococcum* (A. Gray) Heller.
*Vaccinium nigrum* (Wood) Britton.
*Vaccinium vacillans* Kahn.

In addition to the foregoing and incomplete list there must be added at least three unidentified species of grasses.

During the last three years a number of attempts, with varying success, have been made at Washington, D. C., to grow plants of *C. umbellata* and *C. pallida*, both by germinating the seed and by transplanting rootstocks to beds ad pots in greenhouses. In every case where living rootstocks unattached to host plants have been transplanted to pots or beds without the host plants present, little or no growth on the part of the plants of *Comandra* spp. has taken place, and the plants eventually died.

The results from the writers' experiments indicate that when the rootstocks of plants of *Comandra* spp. are broken entirely loose from their root attachment to host plants they usually die through an inability to reattach themselves. This indicates a greater degree of parasitism in species of *Comandra* than has hitherto been suspected, and will render more obvious the desirability of the destruction of plants of *Comandra* spp. in the vicinity of forest-tree nurseries.

127 – **Anatomical Determination of the Grains of Clover Dodder *(Cuscuta trifolii)* and of *C. suaveolens*** (1). — BERNÁTSKY, J. in *Kisérletügyi Közlemények*, Vol. XVIII, Part 2, pp. 207-119 (German Summary, pp. 219-222). Budapest, 1915.

It is advantageous to determine with accuracy whether the dodder contained in seed samples be *Cuscuta suaveolens* or *C. trifolii*, notwithstanding a decision of the German grain dealers according to which the determination of the diameter of the grain would suffice to distinguish one from the other, all grains whose diameter measures beyond 1.25 mm. being considered as belonging to the first species.

A proposition, affirming the necessity of distinguishing the two species on the basis of a botanical determination, was presented by A. VON DEGEN at the first International Conference for the examination of seeds at Hamburg, and met with general approbation.

It is generally easy to distinguish the seeds of the two kinds of dodder with the naked eye, or with one of the magnifying glasses used in the seed testing stations. In some cases, however, even specialists do not agree on the subject.

In doubtful cases it is therefore necessary to have recourse to the anatomical method suggested by HARZ and latterly again brought forward by GUTTENBERG.

In the Royal Hungarian Seed Testing Station at Budapest, the writer, who disposes of very abundant material, was able to study, much more thoroughly than had been hitherto done, the anatomical structure of the grains of the two species mentioned and of others also. In order to obtain an exact anatomical determination it is necessary to know the morphology of dodder seeds and the visible modifications presented by the tissues during growth.

Concerning the morphology it should be noticed that the structure of

(1) See *B.* July 1911, No. 2316; *B.* July 1912, No. 1111-1112; *B.* June 1913, No. 728; *B.* Jan. 1915, No. 115. (*Ed.*).

the tissues near the hilum differs from that of other grains not only in *C. suaveolens* and *C. trifolii* but also in *C. arvensis* and *C. tinei*, and probably also in all other species of dodder. Near the hilum the internal side walls of the epidermis are not thin, as is usual, but very thick; the palisade cells are remarkably longer, and the second layer of the palisade cells usually has several transverse walls. Towards the interior, attached to the short palisade cells are other cells which gradually become larger and more especially broader, of irregular form, thick walled, forming a very spongy tissue. They recall the sclerenchymatous cells which form tissues with wide intercellular spaces, only their walls are scarcely perceptibly lignified, and several contain starch. These characters show the presence of a hilum, but they cannot be considered as distinctive systematical characters of either the one or the other species of *Cuscuta*.

In connection with the development of the seed, it should be noticed that the perisperm placed between the second layer of the palisade and respectively between those cells which resemble the sclerenchymatous cells placed near the hilum and the endosperm, in unripe seeds is more or less thick according to the seed's stage of maturity, and has cells which still very visibly contain starch. In quite ripe seeds all the cells of the perisperm are empty and wrinkled, the perisperm forming a thin uniform and compressed layer. The presence of amylophorus cells in the perisperm — between the second series of palisade cells and the exterior layer, containing albuminoids, of the endosperm — does not therefore constitute a distinctive systematic character, but a sign of the incomplete maturity of the seed.

The epidermal cells also undergo certain modifications either as they ripen or because of the drying up of the seeds. They may contain more or less starch, or none at all; they are sometimes fresh and projecting, other times withered, wrinkled and therefore flatter. For the anatomical systematical determination of dodder seeds, all these characters should be taken into account. In order to avoid mistakes it is indispensable to examine each time a longitudinal section of the grain through its centre showing parts of the zone around the hilum.

The configuration of the entire radial longitudinal section, and that of the palisade layers should, more than any other characters, form the basis for the determination. The radial longitudinal section shows that the seed of *C. suaveolens* previously softened, when relatively small — and therefore resembling the grain of C. *trifolii* — is about 0.8 mm. in diameter and 1.4 mm. in length. The seed of *C. trifolii* when very large — thus more like the seed of *C. suaveolens* — measures on an average 1 mm. by 1.3 mm. Therefore the seed of *C. suaveolens* is more elongate in form, that of *C. trifolii* more rounded; the ratio between breadth and length being 1 : 1.6 to 1 : 1.7 for *C. suaveolens* and 1 : 1.3 for *C. trifolii*. The grains had been moistened before being examined and were therefore slightly swollen.

As to the absolute size of the seeds of *C. suaveolens*, those coming from Hungary — as various accurate measurements have proved — are in general notably smaller than those measured by MARZ, WEINZIERL and GUTTEN-

BERG. Hungarian *C. suaveolens* grains are (when dry) only 0.80 to 1.43 mm. long, while HARZ, WEINZIERL and GUTTENBERG give respectively as the length of these seeds: from 1.8 mm to 2.2 mm.; 1.65 mm.; and 1.5 mm.

The writer's researches are limited to seeds from Hungary.

Further researches alone can prove whether the difference (which may be called an appreciable one) in the size of the seeds of the dodder generally known as *C. suaveolens* is due to systematical or climatical reasons.

The difference of structure is especially important as the following table shows :

| | Ripe seeds of | |
|---|---|---|
| | *C. trifolii* | *C. Suaveolens* |
| Length of cells in first palisade layer . | 11-19 μ | 18-28 μ |
| Length of cells in second » » . | 16-24 μ (that is slightly more) | 40-52 μ (that is about double) |
| Width of cells near hilum of first palisade layer . . . . . | 12-19 μ | 18-40 μ |
| Average width of second layer . . . . . | 32 μ | 56-90 μ |
| Starch granules in endosperm cells are. . | composite | simple |
| Width of starch granules in endosperm cells. | 7 μ | 4 μ |

These characters are sufficient to distinguish the grains even when they are empty and contain no germ.

It was found necessary also to study the so-called calcareous (Kalkig) seeds of dodder; that is to say those of a whitish colour, crumbling easily under the pression of pincers, dry and apparently deteriorated by disease.

The writer has proved that these seeds do not show any trace of parasites but are non-fertilized, having become hard and dry in the stage they were in when pollinated. Their cell walls are relatively thin and unaltered, the interior is filled by the perisperm, with starch cells; they have a small cleft in the middle at the place of the embryo and of the endosperm which have not developed. The breadth and length of the "calcareous" grains of *C. trifolii* are in the ratio of 1 : 1.4; for *C. suaveolens* the ratio is from 1 : 1.6 to 1 : 1.9. In "calcareons" seeds of *C. trifolii* the cells of the first palisade layer are 6 to 8 μ long ; those of the second series about 8 μ; only those of the hilum being longer than 8 μ. The respective lengths for "calcareous" seeds of *C. suaveolens* are 8 to 16 μ for the first series; from 10 to 30 μ and beyond for the second series of the palisade layers. The starch granules in the "calcareous" grains do not present any differential character of systematical value.

128 - **Treatment of Weeds Infesting Corn Crops by Means of Sulphuric Acid.** — MORETTINI, A. in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLVIII, Fasc. 10-11. pp. 693-716. Modena, 1915.

The writer summarizes previous work — beginning with that of J. PH WAGNER (1887) — on the destruction by chemical means of weeds infesting corn crops: sulphate of copper, nitrate of copper, sulphate of iron and sul-

phuric acid (1) and gives an account of his experiments which prove that the direct manuring of wheat (especially when only superphosphate is employed) increases the harvest when the ground is harrowed, hoed and weeded but diminishes the yield when the fields are allowed to be overrun by weeds especially in damp seasons. When the wheat does not receive much cultural attention, the first problem to be solved is consequently that of eliminating all infesting weeds. The experiments were carried out on the experimental field and on the farms of the Royal Agricultural Institute of Perugia (Italy). The writer employed a 10 per cent aqueous solution of sulphuric acid (Baumé 66°). In 1914 spraying was carried out: *a*) at the rate of 89 gallons per acre, on a piece of ground only slightly infected by weeds, in order to observe the effect of the acid on the cereal, and ; *b*) at a rate varying between 67 to 134 gals. per acre on different lots of ground heavily infested with weeds in order to observe the effect of the acid on the weeds.

In 1915 the experiments were repeated. Comparing the advantages of the sulphuric acid treatment with those obtained by hoeing and hand weeding, the following results were obtained :

Treatment of the wheat seed beds with sulphuric acid at the proper time (towards the middle of February), did not diminish the production ; on the contrary in more than one case the yield was so much increased as to repay all the expense of treatment (the increase in yield reached as much as 6 bushels per acre).

As regards the eradication of weeds the action was only partial, a small proportion of the weeds remaining undestroyed.

*Avena fatua* and all other weed grasses proved resistant, also Liliaceous plants (*Allium rotundum* L., *A. vineale* L., *Ornithogalum* spp., *Muscari* spp). and all species of *Medicago*. — The acid has no action on plants which germinate after treatment ; these are, however, not numerous. Amongst the most troublesome weeds that were killed by the acid, may be included : all vetches and species of *Lathyrus*, poppy, *Adonis aestivalis*, *Sinapis arvensis*, *Specularia speculum*, *Ranunculus arvensis*, *Centaurea cyanus*, and *Daucus carota*. The solution applied at the rate of 134 gals. per acre, had a strongly destructive effect, but even 89 gals. per acre is sufficient.

Comparative tests have shown that when the wheat is drilled the sulphuric solution is less favourable to an abundant yield than hoeing. The contrary applies where the wheat is broadcasted. Merely weeding by hand has produced very inferior results to those given by hoeing or by the sulphuric treatment both as regards the crop increase and the destruction of noxious plants.

The cost of the three methods : spraying, hoeing and hand weeding ; being about the same, that particular one should be adopted which is most suited to local conditions. Hoeing should be preferred when the wheat has been drilled ; when broadcasted and heavily infested with weeds, the sulphuric treatment is preferable.

The sulphuric treatment has been advised not only for destroying

(1) See *B* Oct. 1913, No. 1218. (*Ed.*).

weeds but also against *Ophiobolus* or wheat straw blight. From his own experiments on this subject and also from those of others the writer concludes that the efficacy of the sulphuric treatment in this respect is doubtful.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS

GENERALITIES

129 – **Insects Affecting Vegetable Crops in Porto-Rico.** — JONES, THOMAS H. in *Bulletin of the U. S. Department of Agriculture*, No. 192, 11 pp., 4 pl. Washington, 1915.

It may be said in general that vegetables, the cultivation of which could well be extended in Porto Rico, suffer at present severe injury from insects in that island.

The writer enumerates the species more commonly injurious to the various crops.

Beetroot :
*Pachyzancla bipunctalis* Fab.

Horse-radish :
*Pieris monuste* L.

Cabbage :
*Scapteriscus didactylus* Latr.
*Plutella maculipennis* Curtis
*P. monuste* L.

Kale :
*P. monuste* L.
*Pl. maculipennis* Curtis.

Cucumber :
*Aphis gossypii* Glov.
*Diabrotica bivittata* Fab.
*D. innuba* Fab.,
*Diaphania hyalinata* L.

Onion :
*Thrips tabaci* Lind.
*Laphygma frugiperda* S. and A.

Beans :
*Entellix tenella* Baker (?).
*Eudamus proteus* L.
*Empoasca mali* L. and B.
*Cerotoma denticornis* Oliv.
*Nacoleia indicata* Fab.

Maize :
*Peregrinus maidis* Ashm.
*Pseudococcus* sp. (near *Ps. citri* Risso)
*Diabrotica graminea* Baly.
*Laphygma frugiperda* S. and A.
*Heliothis obsoleta* Fab.
*Agromyza parvicornis* Loew.

Okra :
*Diaspis pentagona* Targ.
*Diabrotica graminea* Baly.
*Solenopsis geminata* Fab.

Egg plant :
*Saissetia hemisphaerica* Targ.
*Hemichionaspis minor* Mask.
*Corythaica monacha* Stäl.
*Scapteriscus didactylus* Latr.
*Epitrix cucumeris* Harris (?)
*Pachyzancla periusalis* Walk.

Melon :
*Aphis gossypii* Glov.
*Diabrotica bivittata* Fab.
*D. innuba* Fab.

Sweet Potato :
*Spartocera batatas* Fab.
*Chactocnemia apricaria* Suffr.
*Pilocrocis tripunctata* Fab.
*Criptorhynchus batatae* Waterh.
*Coptocycla signifera* Herbst.
*Cylas formicarius* Oliv.
*Phlegethontius convolvuli* L.

Pepper :
*Aleyrodes* sp.
*Diaspis pentagona* Targ.

Tomato :

*Scapteriscus didactylus* Latr.
*Phlegethontius sexta* Joh.
*Aleyrodes* sp.

Turnip :

*Scapteriscus didactylus* Latr.
*Pieris monuste* L.
*Plutella maculipennis* Curtis.

Radish :

*P. monuste* L.

Celery :

*Pseudococcus* sp. (near *Ps. citri* Risso).

*Sinapis* sp :

*P. monuste* L.
*Pl. maculipennis* Curtis

Squash :

*Diabrotica bivittata* Fab.
*D. innuba* Fab.
*Diaphania hyalinata* L.

" Yautia " :

*Corythuca gossypii* Fab.

130 – **Dispersion of Gipsy-Moth Larvae by the Wind.** — COLLINS, C. W. in *United States Department of Agriculture, Bulletin* No. 273, 23 pp., VII plates. Washington, D. C., August 24, 1915.

The territory infected by gipsy moth (*Porthetria dispar* L.) is gradually increasing in area, and since isolated colonies are being found each year in woodlands and orchards remote from lines of travel, the question as to their origin has become more urgent.

Many agencies assist in the transportation of the moth in its various stages, but as previous experiments proved that small caterpillars are borne by the wind, it seemed desirable to ascertain to what extent this occurs and the maximum distance they may be blown under field conditions. Much depends upon this factor in diffusion, when devising methods of preventing the spread of this pest, and as a practical result of previous experiments " tanglefoot " has been used extensively in colonies located in the outside infested towns. Trees are banded with tanglefoot to prevent the small larvae from ascending to the tops, and thus the chances that these larvae will be blown long distances are decreased.

To secure further information, the writer, under the direction of Mr. A. F. Burgess commenced a series of experiments in the spring of 1913 and continued them throughout the following year.

Seeing that the main purpose of the following investigations was to secure data on the maximum distance and the extent to which small larvae are borne by the wind, it was necessary to find conditions where an abundance of larvae were present in close proximity to treeless areas. These conditions were best afforded along the beaches in Massachusetts and New Hampshire where there are stretches of marshland from 1 to 2 ½ miles wide and many miles long. These marshlands are occasionally flooded with salt water and do not contain vegetation favorable to the development of gipsy-moths larvae. The areas selected for the experiments were to the east of the heavy infestations, thereby getting all the advantages previously known to accrue from the northwest, west, and southwest winds. The Isles of Shoals, off the coast of New Hampshire, afforded ideal conditions in so far as their remoteness from the mainland was concerned and the fact that the country opposite has been infested since 1905. Locations were also selected in the Hills of New Hampshire near the quarantine line for

experiments intended to explain the sources of many infestations found under such conditions.

Screens of poultry wire, to which tanglefoot was applied, were erected in three of the selected locations along the coast and on the Isles of Shoals. Those used in the New Hampshire hill experiments were of a somewhat different type and are described under that head. The screems used along the coast were of $^3/_4$ inch mesh poultry wire stapled to 2 by 4 posts, held in place by guy wires and wooden braces. The posts were 12 feet high and two sections of wire each 75 feet long and 3 feet wide were fastened to these so that the top selvage was 12 and the lower 6 feet from the ground. The screens contained 450 square feet of wire and were built in three 35 foot sections, the middle section facing the west and the other two angling from the ends about 45° to the eastward. This gave the greatest exposure at all times to the northwest, west, and southwest winds. A runway was attached to the posts at the bottom selvage of the wire to facilitate examinations.

The screen experiments were conducted at Salisbury Beach, Mass., on Plum Island Mass., on Isles of Shoals, N. H., dispersion experiments were conducted on the hills of New Hamsphire.

The results are summarized as follows:

In 1913, as a result of the several experiments conducted by using tangle-footed screens and cloth for traps, there were caught on 977 square feet 289 first-stage larvae which had been borne by the wind one-eighth to 1 mile or more. In 1914 there were removed from 1 614 square feet of sticky surface 346 larvae which had been blown from one-eight to 13½ miles or more, as verified by the wind records taken at or near those points. Three larvae were also taken from two large screens on the hills in New Hampshire during 1914.

Considering the great numbers of larvae taken in these experiments, there can be no doubt that the wind is almost wholly responsible for the general spread of this insect in New England, notwithstanding the fact that many of the former publications teem with explanations of possible accidental or artificial spread by man and animals. The recent establishment by the Federal Horticultural Board of a Quarantine (1) on lumber products, Christmas trees, nursery stock, and stone moving from the infested territory, until inspection has been made, has greatly relieved the danger of a general distribution of the gipsy and brown-tail moths over the United States, but the sources of dispersion of the gipsy moth by the wind can only be lessened by the effectiveness of the parasites and predaceous enemies, together with hand methods of control. To prevent continual spread by the wind into new territory the badly infested areas near the border must be brought under control either by natural enemies, or hand methods, or both. Natural enemies, however, are now playing an important rôle in the control of this insect in the greater area of the inside infested territory.

The larvae are sufficiently active and allow themselves to be trans-

(1) See No. 182, *B.* February 1913. (*Ed.*).

ported by the wind at temperatures of 55° F. and above, and have been caught at wind velocities varying from 2 to 23 miles per hour, although more active spread takes place when the temperature ranges from 65° to 85° F. and when the velocity reaches 8 miles or more per hour. Larvae are removed from their support and carried by sudden gusts of wind, whether they spin or not, when the temperature reaches 50° to 55° F., at which temperatures they often start crawling.

The records also show that larvae have been caught at times when winds were blowing from all directions except the north only a very few coming from the east, but the location of the screens along and near the coast materially affected this condition. By far the larger numbers were borne by combinations of the west winds as indicated on the screen at Merrimac Mass., which was surrounded by a general infestation.

The general progress of the species since its establishment at Medford, Mass., at the rate of 5 miles per year to the northeast and at the rate of 3 miles per year westward from Providence, R. I., since its first appearance there in 1901 tends to verify the data that have been collected in connection with the screen experiments.

31 – **Life History of the Codling Moth in Maine.** — SIEGLER, E. H. and SIMANTON, F. L. in *United States Department of Agriculture Bulletin* No. 252, 50 pp., 9 figs., 2 plates. Washington, D. C., August 10, 1915.

In order to ascertain the variations in the life history of the codling moth under diverse climatic conditions, investigations have now been completed in widely separated districts, such as Maine and New Mexico, as well as in representative intermediate localities. The methods of study have been essentially the same wherever the work has been undertaken. In this bulletin a detailed account of the life history of the codling moth under Maine conditions is reported as well as a brief mention of the means of control.

The life-history studies of the codling moth herein recorded were conducted during the seasons of 1913 and 1914 at Winthrop, Me.

The codling moth in Maine has one full generation, a very small percentage (1 to 2 per cent.) of the individuals of which transforms to make a partial second generation.

Pupation of the overwintering larvae begins about the middle of May and extends to the first part of July. The length of the spring-brood pupal stage averaged 21 days.

The moths of the spring-brood begin to emerge about two weeks after the petals have fallen and continue to issue for a period of about a month.

The average time from the date of emergence of the moths to first oviposition was about four days. The oviposition of the spring-brood moths average 14 days. The average length of life of the male spring-brood moth was about 12 days; of the female about 13 days.

The earliest first-brood eggs were deposited approximately three weeks after the petals dropped.

The incubation period of the first brood eggs averaged eight days.

These latter began to hatch in from four to five weeks after the petals had fallen.

The transforming larvae of the first brood fed for a period of about 22 days while the overwintering larvae of the first brood had an average feeding period of 28 days.

The female larvae of the first brood fed for a longer period than the male.

The average time spent by the transforming larvae in constructing their cocoons was about six days.

Approximately from 1 to 2 per cent of the first brood larvae transformed to first brood pupae. The remainder of the larvae did not transform until the following spring (spring pupae).

Pupation of the first or summer brood commenced during the latter part of July. The average length of the first brood pupal stage was 15 days.

The first or summer brood of moths began to emerge just previous to mid-August and continued to issue for a period of about one month.

Oviposition by moths of the first brood began about mid-August.

The life cycle of the first generation from the time of egg deposition to the emergence of the moth was 51 days and complete life cycle from the time of the deposition of the egg of one generation to the deposition of the egg of the next generation was about 55 days.

The average incubation period of the second brood of eggs was 11 days and the average feeding period of the second brood larvae was 46 days, the female larvae of the second brood feeding for a longer time than the male.

The hymenopterous parasite *Ascogaster carpocapsae* Vier. was frequently reared.

The well-known beetle enemy *Tenebroides corticalis* Melsh. was commonly found attacking codling-moth larvae.

The codling moth in Maine may be controlled with one spray thoroughly applied as soon as the petals drop. Arsenate of lead paste, 2 pounds or if in powder 1 pound, to each 50 gallons of water is recommended.

132 – **Studies of the Codling Moth in the Central Appalachian Region.** — BROOKS, F. E, and BLAKESLEE, E. B. in *United States Department of Agriculture* Bulletin No. 189. 49 pp., 23 figs, 1 plate. Washington, D. C., April 12, 1915.

In many localities throughout the central Appalachian region the recent rapid development of the apple-growing industry has made the control of the codling moth (*Carpocapsa pomonella* L.) a subject of special and increasing interest. The hilly or mountainous nature of the land has led to the location of orchards at elevations ranging from a few hundred feet to more than 4000 feet above the level of the sea. The great diversity of temperature that occurs between the lower and the more elevated orchards has a marked effect on the time of transformation of the different stages of the codling moth, and consequently has direct bearing on the relative number and the destructiveness of second brood larvae.

In the spring of 1911 the Bureau of Entomology began a study of the codling moth in the region just mentioned, as a part of its investigations

of this insect throughout the United States, giving particular attention to the time of appearance of the different broods at various altitudes and latitudes.

Band record studies were conducted in 1911, 1912 and 1913 in several different localities of Virginia, West Virginia, and Maryland.

The stations at which the investigations were conducted comprise a difference in latitude of about 1°.40' and in altitude of about 3 100 feet. The most southerly and least elevated station was at Charlottesville, Va. the most northerly at Hagerstown, Md., and the one at highest elevation, at Pickens, W. Va.

The chief features of the investigations consisted of banding suitable apple trees with strips of burlap, collecting at regular periods the larvae that went beneath the bands to spin up, and rearing these larvae in jars kept in the localities where the larvae were collected.

Examinations of the bands and rearing jars were made every week or ten days in 1911 and twice a week in 1912 and 1913. No detailed life-history studies were attempted.

During a single year the codling moth, in the region covered by the present studies, produces one full brood of larvae and a partial second brood, the size of the second brood depending more or less on the latitude and altitude of the locality.

The studies show a marked difference in the time of appearance of the different broods in different localities.

Charlottesville gave the earliest records for practically all broods and Pickens the latest.

There seems, however, to be no constant rate of difference between the earlier and later localities. This seems to be largely due to the responsiveness of the species during its metamorphic changes to local and transient weather conditions.

During the time of the investigation the first-brood larvae began entering the fruit at Charlottesville from April 28 to May 15, and second-brood larvae from June 25 to July 1. At Pickens first-brood larvae began entering the fruit from June to 20 July 1, and second-brood larvae about August 10. Between these two localities there is a greater difference in the time of the regular periodical changes of the insect that occur late in the season than of those that occur early in the season. This is probably due to the cumulative retarding effect of the more frequent unfavorable weather conditions at the higher point.

For any given locality the variation in the time of appearance of spring broods in different years is greater than that of corresponding summer and all broods of the same years.

Records of the number of larvae collected from trees on which bands were placed around the trunks and also around the bases of the larger branches indicate that 41.49 per cent drop to the ground and then ascend the trunk to pupate and 58.51 per cent. crawl down the branches from the infested fruit to pupate.

Where a collection of larvae is confined in one jar there is apt to be a

considerable loss due to cannibalism. It is probable that the weaker larvae are sometimes devoured by their fellows under normal conditions.

Two specimens of ants (*Solenopsis molesta* Say and *Lasius niger* L. var. *Americana* Emery) were found in several localities devouring codling moth larvae. Larvae and adults of the beetle *Tenebroides Corticalis* Melsh. were found frequently feeding on codling-moth larvae and pupae. Six species of hymenopterous and one of dipterous parasites were reared in the jars. Of these the most destructive to the codling moth were *Ascogaster carpocapsae* Vier. and *Itoplectis marginatus* Ror. Hairworm parasites (*Mermis* sp.) were abundant in one locality and very materially reduced the number of wintering larvae in the year 1911.

MEANS OF PREVENTION AND CONTROL

133 - ***Chilocorus 4-pustulatus*, a Natural Enemy of *Aphis persicae* and perhaps also of *Eriosoma lanigera*, in Argentina.** — RIVEROS, E. in *La Enologia Argentina*, Year I, No. 6, pp. 163-164. Mendoza, 1915.

The writer, when visiting in February 1915 the Agricultural School of San Juan, noticed numerous coleoptera, which he identified with *Chilocorus 4-pustulatus*, on the fruit peduncles and in the creases of the leaves of those peach-trees that had been attacked by *Aphis persicae*, while all trace of that aphid had disappeared. He therefore concluded it to have been destroyed by the coleoptera which, on the other hand, were not to be found on peach-trees that *A. persicae* had not attacked.

The same *Chilocorus*, according to information received by the writer, was seen on apple-trees attacked by *Eriosoma* (*Schizoneura*) *lanigera*.

Specimens of the coleoptera were distributed on peach-trees at the Agricultural School of Cordoba, but as the season was advanced and the generations of *A. persicae* almost ended the writer was unable to draw any conclusions as to the good effects of *Chilocorus*.

INSECTS INJURIOUS TO VARIOUS CROPS

134 - ***Phlyctaenodes sticticalis*, Microlepidoptera Injurious to Plants Cultivated in Hungary.** — JABLONOWSKI, J. in *Köztelek*, Year 25, No. 32, pp. 1157-1160. Budapest, 1915.

Between the 23rd and 30th of July 1915 reports were sent to the Royal Hungarian Entomological Station to the effect that in four localities of three counties of Transylvania, an unknown larva causing serious and unexpected havoc, had made its appearance. It attacked in swarms the fields of lucerne, clover, horse beans, maize, pumpkins, potatoes and peas. In one of these places Fiátfalva (county of Udvarhely) it destroyed completely whole fields of lucerne and clover. In other places it invaded both kitchen gardens and fields. By examining much material (larvae and adults) taken from the infected districts the Station was able to prove the insect in question to be the same which appeared in Hungary during 1901 : *Phlyctaenodes sticticalis* L. (= *Loxostege sticticalis* L. or *Eurycreon sticticalis* L.). Since then it was not again seen except in 1905 in one place only, Ujszász (county of Pest).

*Phl. sticticalis* can in a few days and sometimes even hours ravage kitchen gardens and fields, especially at the beginning of the growing season.

This extremely active insect comes from Russia where it has at differ-

ent times caused considerable havoc ever since 1769. It is also known in the United States where it was probably introduced from Russia. In America and also more recently in Russia, the parasite has shown a marked preference for sugar beets although it devours also other plants.

With the exception of this parasite's appearance in one single locality in 1905, the insect was fourteen years before again recurring in great swarms in Hungary. The writer has not been able to ascertain whether in the course of these fourteen years the insect has lived on weeds without attracting the notice of farmers or whether the present invasion was a tardy generation of the parasite which infested Russia during 1909, 1912 and 1913.

The writer describes the life history of the insect and gives the measures of control adopted in Russia and in America. In Hungary only one generation of *Phl. sticticalis*, namely the July one, has hitherto caused unforeseen damage. The following generation disappeared leaving no trace. No serious attention was therefore given to prevent a further spread of the insect. Nevertheless the writer advises the following means of control: to surround the infested fields with a ditch and to destroy the larvae all along it; to spray the yet unattacked portions of the infested plants with a 3 to 5 per cent. solution of barium chloride and to plough the soil deeply in the infected places, always and everywhere destroying all weeds.

135 – **The "White Cochineal of the Vine" *(Pseudococcus vitis)* in the Provinces of Mendoza and La Rioja (Argentina).** — SANZIN, RENATO in *La Enologia Argentina*, Year I, No. 6, pp. 164-165, Fig. 89. Mendoza, 1915.

The existence of *Pseudococcus vitis* (syn. *Dactylopius vitis*) has been noticed for some time past at Mendoza, and informations received from Rioja state that the scale insect locally known as "mosquilla blanca de la vid" is menacing the recently started cultivation of the vine in that province.

The writer describes the insect and draws attention to the fact that while in Europe it has two generations in the course of the year, in the above mentioned regions, owing to the warm climate, it may have even more than three. The individuals of the last generations hibernate under the bark of the stocks, hence the necessity of removing the bark from the vines in autumn so as to destroy the largest possible number of individuals. The plants are then treated with sulphur-lime wash or petroleum emulsion.

136 – ***Bombyx pini* Injurious to Pine Trees in Austria.** — SEITNER, in *Centralblatt für das gesamte Forstwesen*, Year 41, Nos. 5-6, pp. 161-173. Vienna, 1915.

The extensive damage caused in 1913 by *Bombyx pini* to a forest in the environs of Vienna, have afforded the writer an opportunity of illustrating the life history of this insect. The forest grows on indifferent soil and consists principally of the black pine, which is felled every 80 years and replaced by new plantations. The age of the trees varies a good deal; the needles are generally removed so that the humus layer is very thin. Besides black pine, the forest contains oaks, hornbeams and elms, it is surrounded by large fields under hoed crops. All these circumstances explain the existence of the numerous species of insects in the forest.

In November 1912, during his first visit, the writer found a great num-

ber of old cocoons in the bark of the pines and in the hedges, whence he concluded that the forest had already been invaded by the insect. Later he was able to collect from 300 to 400 small winter caterpillars per felled tree. This proves that the caterpillars, or at least some of them, remain on the trees even during the winter.

Black pine, because of the fissures in its bark, appears to be more favourable than white pine to the wintering of the caterpillars in the crown.

To prevent the caterpillars of *Bombyx* from climbing up to the crown, a band of cloth, previously steeped in glue, was placed round the trunk of the trees. The total expense amounted to 13*s* 6*d* per acre. On the 6th of the following March the writer already observed some caterpillars beginning to ascend and on the 22d the ascension had become general. Later he found under the band as many as 600 caterpillars. The biggest trees were generally the most infested, but the caterpillars were unable to pass the band and reach the crown of the pine trees.

Besides the *Bombyx* caterpillars, the writer found under the glue bands different species of arthropoda such as : arachnidae belonging to the families of *Salticidae* and *Thomasidae* ; *Trobidium fuliginosum* Koch ; an ichneumonid and *Coccinella quadripunctata* Pont., *Anatis ocellata* L., *Halyzia vigintiguttata* L. ; *Diacanthus aeneus* L., *Helops quisquilius* Sturm.; *Pogonochaerus fasciculatus* Deg.; *Seythropus mustella* ; *Brachyderes incanus* L. *Pissodes validirostris* Gyll.

Further examination of the trees showed that the caterpillars were quite unable to pass the glue bands for the crowns were not at all damaged. Glue is an excellent means of protection, but it must not be allowed to dry during the summer. The transformation into chrysalides was more intensified on the borders of the forest and in the zones where young and old trees grew together.

Examination of the collected caterpillars has shown that 90 % were attacked by parasites. This encouraged the writer to leave the contest to nature, and in 1914 he took no preventive measures. The experiment was valid for in that year the forest was attacked only by a small number of *Bombyx* and in the summer of 1915 the writer found them in still smaller numbers. Last August neither eggs nor caterpillars nor adult insects were found in the forest.

The study of the parasites attacking *Bombyx pini* gave the following results :

1. Parasites of the winter caterpillar. — Fewer parasites than on the summer caterpillar or chrysalis ; the following species were found *a*) the larvae of a braconid, probably *Rhogas esenbeckii* Hartig, described by Ratzeburg ; it develops in the body of the caterpillar producing hardening of the skin on which appear excrescences ; in May and June the parasite leaves the caterpillar which then dies ; *b*) *Exochilum giganteum* Grav.; it penetrates and develops principally in the young caterpillar and afterwards in the chrysalis, where it remains till the end of July ; it leaves the adult insect in the beginning of August ; this parasite is less efficacious than the first one *c*) a parasite belonging to the sub-family of the *Ophioninae* not yet iden

ified; the host is deformed and soon dies; *d*) *Apanteles fulvipes* Reinh, has ittle effect.

Larvae of tachinidae were not found on winter caterpillars. Several undreds of winter caterpillars artificially bred by the writer have given: 1 specimens of *Zygobothria bimaculata* Htg. hatched in May, and a single pecimen of *Pales pavida* Mgn. = *P. ciliapeda* Roh.

2. PARASITES OF FULL GROWN CATERPILLARS AND CHRYSALIDES. — From he 1598 chrysalides and full grown caterpillars collected by the writer at he end of June and beginning of July, 371 moths were hatched, that is 8 %; 1,5 % of the caterpillars and chrysalides had died; 3 % of all the hrysalides and caterpillars contained an ichneumonid and 76,6 %, larvae f tachinidae and sarcophagidae. The tachinidae were almost exclusively epresented by *Blephariopoda scutellata* R. D. and the sarcophagidae by *Sarcophaga affinis* Zall., *S. atropos* Mgn. and *S. carniaria albiceps*. The greatest enemy of *Bombyx* was *Bl. scutellata* which destroys above all the arvae and chrysalides which reach full development towards the middle f July.

The sarcophagidae have not been studied in detail by the writer.

The ichneumonidae were mostly represented by *Exochilum giganteum* Grav.; *Theronia atalantae* Krieg, *Pimpla instigator* and *Monodontomerus dentipes* Roh.

The principel parasite of the *Bombyx* egg was *Teleas laeviusculus* which ppears to have been very useful.

The writer has not identified other enemies of *Bombyx pini*.

CONCLUSIONS: 1) the few caterpillars which remain during the winter n the crown of the pine trees do not diminish the practical value of employing glue bands; 2) in order to localize the most infested places it is needful to collect, during the winter, the larvae from a certain number of trees in each one and then compare the quantities collected; 3) the opinion according to which ichneumonidae are the natural and most efficient enemies f the *Bombyx* should not be generalised; in the forest under consideration the enemies were *Blephariopoda scutellata* and the sarcophagidae; he egg of the insect is chiefly attacked by *Teleas laeviusculus*; 4) the pine-eedle bed should not be removed as it affords a good medium for the natural enemies of *Bombyx* and especially of the winter caterpillar; 5) the most important parasites of the insect are those which attack the summer caterpillar and the chrysalides.

ALFREDO RUGGERI, *gerente responsabile*

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

# INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.
The Editor's notes are marked (*Ed.*).

FIRST PART.

# ORIGINAL ARTICLES

## Meteorology in Relation to Agriculture in Canada

by
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and
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A systematic climatological survey of the Dominion has been the primary work of the Meteorological Service, and records of the weather covering periods ranging from a few years to 45 years are now existent in all the Provinces. From these records mean values of the various factors of the weather such as temperature, rain and sunshine, have been deduced, and are available to agriculturists and others who may desire them.

A meteorological equipment has been placed at each of the Experimental Farms and the data which are being obtained by observers are certainly of use to the farm in its usual activities, as well as to the student of agricultural meteorology.

From the earliest days of the Service, much thought and attention has been devoted to weather forecasts, which are disseminated in all the provinces of the Dominion. Contracts have been made with the various telegraph and telephone companies for the transmission of the forecasts to nearly every point reached by wire, and it only remains to arrange that the bulletins now received at the telegraph office be disseminated more generally among the farming community and others living away from populous centres. Some progress has been made in this direction inasmuch as, at a large number of towns in Ontario, a copy of the daily forecast issued at 10 a. m. is delivered at the telephone exchange, and subscribers on rural lines have been informed that they can obtain the weather forecast by calling the central office; also in the Maritime Provinces, where the dissemination of the forecasts is as a general rule arranged by telephone, subscribers can easily obtain the forecasts.

It is probable, however, that it is through the press that the largest number of farmers obtain the forecasts; and this number is constantly augmented as the rural mail routes become more general.

The forecasts are issued twice daily — at 10 a. m. and 10 p. m. and are based on weather maps prepared from observations all over the continent two hours earlier. It is the 10 a. m. forecast which is disseminated most generally in the Dominion, but the 10 p. m. forecast is of high importance as it is this which appears in the morning newspapers in every province.

Many years ago arrangements were made with the railway companies whereby weather signals were carried on the baggage vans of trains. The experiment was not, however, wholly satisfactory, as there was difficulty in making the station agent see to it that the signal was changed from day to day in accordance with the forecasts, and trains would at times carry a fine weather signal when it should have been bad. Another consideration in connexion with train signals and the use of flags, is the difficulty of conveying an idea of the coming weather by means of one signal. It is seldom in Canada that days are wholly rainy, and in summer especially there are very many days which are for the most part fine, but in which thunderstorms occur in some localities. The idea of such conditions may be conveyed with fair accuracy in several words, but with only one word it becomes a matter of uncertainty whether "fine" or "showers" will best suit the situation.

We believe that there is no section of the farming community which can be more profitably assisted by weather forecasts than the fruit growers, inasmuch as it is possible, in a large majority of instances, to predict frost with accuracy, or at least to inform the fruit grower that he should be on the *qui vive*, where the temperature is tending towards the freezing point.

It is certain that under existing arrangements any farmer in the more thickly populated portions of the country may by noon obtain the weather forecasts for the coming night and following day, and a strong endeavour will be made early in the next year to make it still more simple to obtain the weather bulletins.

It is thoroughly recognized in the Meteorological Office that the aim of the meterologist must be to forecast for a longer period than is at present possible, and indeed to outline the general character of coming seasons. With a vast accumulation of data and a period of experience covering several decades, the forecast officers of Canada, having made the attempt, must confess that generally speaking forecasts covering 48 hours are not sufficiently accurate to warrant publicity. In nearly every season there are some periods when the movement of areas of high and low pressure are most erratic, and in some seasons the erratic movements are quite prevalent for long periods; it has been specially noticeable that severe storms and large temperature changes have seldom been foreseen many days in advance.

The writer is, however, confident that when variation in solar radiation is more fully understood and accurately measured, it will be found that careful correlation of this with the changes in the atmospheric distribution

over the globe, and the wind changes consequent therefrom, will provide a general basis for determining seasonal variations in climate.

The channels through which the agriculturist may obtain a knowledge of the climate of his district are the Annual Climatological Report of the Service, the Monthly Weather Review, and the Monthly Weather Map. *The first* of these gives summaries of the monthly and annual mean values of every meteorological station and tables of the monthly values of rain and snow. The *Monthly Review* gives mean values for the month, and a general summary of the weather conditions that have obtained. *The Map*, which is published three days after the close of the month, shows the mean temperature in each of the provinces of the month just closed, the departures from average mean temperature, and the total precipitation, also in winter the depth of snow lying on the ground on the last day of the month. In the text is given a general outline of the weather conditions and also a brief summary of crop reports obtained by telegraph through various agencies in the different provinces.

The agricultural section of the Meteorological Service, established in 1914, has, during the season of 1915, co-operated with the Dominion Experimental Farms System, in a field experiment on spring wheat in relation to the weather, or meteorological environment. A plot of Marquis variety was grown at each of fourteen stations, distributed throughout Canada from the east to the west coasts. At every station regular daily records were, and indeed have been for a varying number of years, taken of precipitation, maximum and minimum temperatures, and bright sunshine.

Observers recorded crop notes on a printed form, adapted from a model translated from Russian. The questions called for a good deal of information, including: 1) general field conditions, and the farming methods employed; 2) dates of the important stages in the life of the wheat, from sowing to reaping, and the general condition of the plants at the time of the stages; 3) average height of plants on the plot every seven days; 4) the damaging effect of adverse weather phenomena on plants and soil at any time throughout the season, and losses due to meteorological and to other factors; and 5) final yield and quality. After threshing time, the complete forms are returned to the Central Office of the Meteorological Service, where the weather and crop data are correlated.

But before an attempt at such correlation was made, every experimental station engaged in the co-operative work was visited and a knowledge of conditions, climatic and agricultural, obtained at first hand.

During the coming winter of 1915-16 all possible data will be recorded by a graphical method, and by tables, and correlations of wheat and weather studied, and cautious conclusions will be drawn.

The work is founded on the valuable precedent set by Russia in agricultural meteorology, and it is hoped to learn all that is possible about the details of this Russian work from translations of publications in Russia during the past fifteen years. It is hoped, too, that equipment and methods may be perfected, so that a serious field attack may be made on the great problems presented in agricultural meteorology.

# Fishing and Fish Culture in Hungary

by

JEAN DE LANDGRAF

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*Species.* — Hungary has a very rich and varied fauna of fresh water fishes; rich owing to the very favourable nature and temperature of the running and standing waters of the country; varied because the water courses being distributed between two seas include the most valuable species. Ichthyologists recognise 67 fresh-water species classified as follows:

I. TELEOSTEI.

** 1. *Perca fluvialis* L.
* 2. *Lucioperca sandra* Cuv.
* 3. *Lucioperca volgensis* Pall.
4. *Aspro vulgaris* Cuv.
** 5. *Aspro zingel* Cuv.
6. *Acerina cernua* L.
7. *Acerina schraitzer* Cuv.
8. *Eupomotis aureus* Walb Jordan.
9. *Cottus gobio* L.
10. *Cottus pœcilopus* Heck.
11. *Gobius marmoratus* Pall.
12. *Lota vulgaris* Cuv.
* 13. *Cyprinus carpio* L.
** 14. *Carassius vulgaris* Nils.
15. *Carassius gibelio* Nils.
** 16. *Tinca vulgaris* Cuv.
* 17. *Barbus fluviatilis* Agass.
18. *Barbus petényi* Heck.
19. *Gobio fluviatilis* Cuv.
20. *Gobio uranoscopus* Agass.
21. *Rhodeus amarus* Agass.
** 22. *Abramis brama* L.
23. *Abramis vimba* L.
24. *Abramis melanops* Heck.
** 25. *Abramis ballerus* L.
26. *Abramis sapa* Pall.
27. *Abramis leuckarti* Heck.
28. *Blicca argyroleuca* Heck.
** 29. *Pelecus cultratus* L.
30. *Alburnus lucidus* Heck.
31. *Alburnus bipunctatus* Heck.
32. *Alburnus mento* Agass.
** 33. *Aspius rapax* Agass.
34. *Leucaspius abruptus* Heck.
** 35. *Idus melanotus* Heck.
36. *Scardinius erythrophthalmus* Bonap.
37. *Leuciscus rutilus* L.
38. *Leuciscus virgo* Heck.
** 39. *Squalius dobula* L.
40. *Telestes agassizii* Heck.
41. *Phoxinus laevis* Agass.
** 42. *Chondrostoma nasus* L.
** 43. *Cobitis fossilis* L.
44. *Cobitis barbatula* L.
45. *Cobitis taenia* L.
46. *Cobitis elongata* Heck.
** 47. *Esox lucius* L.
48. *Umbra canina* Marsigli.
** 49. *Silurus glanis* L.
50. *Amiurus nebolosus* Günth.
* 51. *Thymallus vexillifer* Agass.
* 52. *Salmo hucho* L.
* 53. *Salmo salar* L.
* 54. *Trutta fario* L.
55. *Salmo irideus* W. Gibb.
56. *Salmo salvelinus* L.
57. *Alosa pontica* Eichw. var. *Danubii.*
58. *Alosa nordmanni* Ant.
59. *Anguilla fluviatilis* Flem.

II. GANOÏDEI.

* 60. *Acipenser glaber* Heck.
* 61. *Acipenser ruthenus* L.
* 62. *Acipenser stellatus* Pall.
* 63. *Acipenser schypha* Güld.
* 64. *Acipenser guldenstädtii* Brandt.
65. *Acipenser huso* L.

III. CYCLOSTOMI.

66. *Petromyzon fluviatilis* L.
67. *Petromyzon planeri* Bloch.

* Species distinguished for the quality of their flesh.
** Species occurring in shoals or important as popular food.

The species numbered 8, 50, 55, 56 have only been introduced recently by means of artificial breeding. Some fish-breeders are experimenting with other species of fish so that the above list will probably be extended. With regard to the multiplication of these species in the different water-courses, research shows that the more extensive the area of water the more varied is the fauna. Thus, the Danube comes first with 40 species, followed by the Tisza with 34, the Zagyva with 32, the Raba and the Körös with 29 species each. The smaller rivers count 14 to 19 species. Of the lakes, Balaton carries 28 species and Velencze only 11.

It should be pointed out that only about a third of the species mentioned in this list are used as food, whilst the rest are only of biological interest.

From the market point of view the most important groups and species are: *Acipenseridae*; *Salmonidae*; *Lucioperca sandra*; *Silurus glanis*; *Esox lucius*; and especially *Cyprinus carpio*; the species of allied genera, such as *Tinca vulgaris, Carassius vulgaris* and finally white fish of less value, but important from a quantitative point of view, are *Abramis brama, Acardinius erythrophthalmus, Leuciscus rutilus* and *Pelecus cultratus.*

*Historical.* — Fish-culture in Hungary may be divided into three distinct periods: 1) abundance; 2) decadence; 3) renascence.

As a source of food and as an occupation fishing has always taken a dominant part in the national life of Hungary. This is attributable to the extent and number of water courses as well as to the favourable natural conditions. The chief river is the Danube which waters a basin about 621 miles long. Along its course it receives the waters of the Tisza, its chief tributary, and of 27 rivers which together total a length of about 5 216 miles and which in their turn are fed by about 600 smaller rivers and streams. In addition to these rivers, the country abounds in lakes, of which the chief are: Lake Balaton (266.5 sq. miles), Lake Fertö (129 sq. miles), Lake Velencze (86.5 sq. miles) etc. With regard to the mountain lakes there are 115 in the Carpathians alone. Hungary also abounds in fish ponds fed by the overflow from the larger rivers into the plains. An idea of their extent is indicated by the 1 135.57 sq. miles of valuable arable land recovered by the erection of dykes and suitable drainage. These shallow flood-waters by reason of their warm temperature are very favourable to the reproduction of fish, so that in mid-summer when the waters begin to recede to their normal beds they contain large numbers, and according to authentic accounts the stocks of fish in the rivers are sometimes increased by flooding to such an extent in favourable years that the Tisza is proverbially stated to contain "more fish than water".

This abundance of fish in the water courses of the plains has given rise to a flourishing fishing industry. Historical documents show that whole generations of families have lived entirely by fishing. The town of Szeged, for instance, was founded by fishermen and in the 15th century there were no less than 4 000 in that place; at Komárom the number of master fishermen alone reaches hundreds.

During the last century there still remained in the river districts flour ishing corporations of fishermen, which constituted the richest elements

of the urban population. Even today the names of fishes and fishing tackle occur in thousands of forms and variations in the names of localities and families. All these examples, which are capable of multiplication and which testify to the former flourishing condition of the industry, indicate also the enormous national consumption of fish.

In Hungary, as elsewhere, the extraordinary abundance of fish lasted only so long as the water courses remained in their primitive state. With the development of agriculture the conditions of life for fishes became more and more precarious, thus leading to the decadence of the industry, which coincided with the boom in agriculture. The farmers interested took the first steps in the construction of dykes against the floods and in the drainage of the flooded lands. On the other hand, in the interests of navigation, the State organised canalisation works and the regulation of the river basins. Apart from the enormous reduction of the fish lands (those in the valley of the Tisza were reduced to $^1/_{10}$th of their former area) the two factors affecting the conditions of life of the fish are: 1) the prevention of the inundation which has deprived the fishes of their spawning places; 2) the control of the river basins means that the flood waters, penned between the dykes, subside at a great rate and are the cause of a lowering of temperature unfavourable to reproduction. Amongst other causes completing the destructive effects of the above factors are: the erection of numerous factories along the river banks, river traffic, and poachers who in the absence of protective legislation have almost exterminated the fish. This has resulted in exorbitant prices for fish preventing its use in the towns, and also in a rapid diminution of the number of fishermen. Although these disastrous effects were resented throughout the country and the necessity of an urgent remedy was realised it was not until 1888 that the Government was able to check these depredations by the passing of the fishing law XIX of 1888 which came into force on May, 1, 1889. Since then the Hungarian fisheries have experienced a renascence. Both State and private enterprise has followed a definite plan which has resulted in the development of the resources of the rivers to such an extent that already in some regions they are sufficient for the needs of the public.

*Legislation.* — According to the terms of law XIX, 1888, the right to fish is inseparable with ownership and belongs to the owner of the particular river bank. The law also establishes a distinction between " closed " and " open " waters, the restrictions being only applied to the latter' since in closed waters fishing may be practised unreservedly by those having the right. Considered as closed waters are artificial ponds and waters surrounded by property belonging to one proprietor or divided amongst several and not communicating with other fishing waters, so as to allow fish to pass from one to another. All other waters are considered as open waters. The authorities reserve the right to decide whether a water is open or closed.

The restrictions concerning fishing practice are identical with those established by legislation in other countries. Thus the method of fishing and the apparatus used are controlled. For the protection of fish of economic value (indicated above by asterisks) the law in question forbids

the taking of these species at a certain period and below a certain size. It also forbids the sale of fish not having the legal dimensions.

This law, however, contains a provision regarding scientific fish breeding and thus anticipated the Bavarian fishing law by 20 years. This original and fundamental provision has compelled licensed fishermen to form an associaf tion for their common interest. The law also provided that in open waters individual fishing rights can only be exercised if the situation and area of the water is such as to allow-fishing in a rational manner without detriment to the interests of neighbouring land owners. In the absence of these conditions fishing rights cannot exist within the limits of the present law except for members of an association. The classification of waters for individual or association purposes is made by the Ministry of Agriculture. In case where individuales having fishing rights are unwilling to form an association or where the association formed is not performing its duty the fishing right can be leased out by the authority for a period of six years, so that it may be possible to ensure the fishing being carried out in a manner best suited to the public interest.

Undoubtedly this provision of the law has imposed very strong restrictions on the use of private property, but in return it should be recognised that it provides, from an economic point of view, a very valuable means of practical control; for, with the large number of owners of fishing rights, a rational and intensive system of fish culture can only be realised by means of a compulsory association applying to all such. As in the case of autonomous organisation, the associations can establish by vote, subject to the rules imposed by the statutes, the control, method and means of fish culture. These associations are called upon to produce a scheme which must be submitted for approval to the Ministry of Agriculture. On being approved this scheme must be adhered to under penalty of legal action and it constitutes a basis on which the proprietors, as the most interested party, may arrange a scheme of intensive cultivation, while in return, the State has the assurance that its financial dealings will not remain unprofitable. Finally, the compulsory approval of the breeding scheme enables the industry to be worked in a uniform manner on any sized area of water and in a manner most suitable to each species of fish according to the natural conditions of the water.

At first, the idea of an association was opposed by those interested, who saw in it a danger to their private rights. Later, however, when tangible results showed the value of fish-culture generally, the founding of associations began to gain ground. The increasing scope of these associations is shown by the fact that whilst at first they were concerned only with the control of the methods of fishing and questions concerning the protection of hitherto unprotected fish, they gradually included the arrangement of leases especially the suitable breaking up of leased lands, the adoption of a long term of letting, and the realisation of a uniform method of culture, so that at the present time a rational system of breeding generally prevails. The direct result of this activity was the considerable increase in rents or the increase of the value of fishing rights which has helped to shake the indiffer-

ence of the public towards the national fish-culture. In this manner there have been established 93 fishing associations representing an area of 65876 sq. miles of land carrying the most valuable fishing in the Hungarian plain. At present the organisation work is being carried on in the salmon districts of the mountain regions. With regard to the annual yield of public waters administered by the associations, no authentic figures are available. However the valuation calculated on the rents gives an approximate yield of 11 000 000 lbs. valued at over £100 000. These works of public value are supported by the State and the experts employed collect the data necessary for organisation purposes, material for reproduction being supplied free, or financial aid being given to associations engaged in breeding. Where the suppression of poaching requires game keepers, the State contributes a certain fixed proportion to the expense of their maintenance.

*Artificial Rearing.* — The provisions of the previous law only apply to open waters and thus the main lines along which the natural fisheries are conducted have already been traced. On similar lines artificial rearing has also begun to gain ground. Its utility being more direct and more certain it soon attracted attention and progressed more rapidly than the natural fisheries. As early as 1870 establishments were already in existence for trout breeding by means of artificial fertilisation. Although these places still remain and have increased in number they have not acquired any real importance. The largest of these establishments maintains itself today by its egg production rather than by its fish. In contrast with this, the practice of artificial incubation has increased in the management of public waters. At the present time there are 180 establishments for the artificial incubation of salmon spawn for the stocking of natural waters. These hatcheries, most of which are situated near streams, are of about 12 to 15 sq. metres in area and consist of small wooden houses provided with incubators of the Californian and other types. The fry are placed in the public waters in spring or even in autumn if the incubators are situated near to the breeding ponds. The staffs of the domainial forests (1) in particular give a great deal of care to fish breeding and are able to show well stocked trout rivers. In emulation of the example of these forest rangers, private breeders have also taken up artificial breeding with the effective support of the State which grants them the free use of the incubating apparatus and, for 3 or 4 consecutive years, of salmon eggs also.

The fish breeding ponds are already much more important and have developed as an independent branch of production, the value of which has been realised by the agriculturists and added to their wealth. The breeding ponds provide a means of obtaining profits from barren lands and also a means of improving them. Up to the present this method of working has been adopted on wet pastures near water courses, but recently ponds have been established on the alkaline lands of Alföld to improve their fertility. The results so far obtained have been so promising that an area of 2 718 acres is being converted into a breeding pond.

(1) See also *B.* Febr. 1913, No. 165. (*Ed.*).

The ponds are primarily destined for breeding of carp in connection with tench and sandra breeding and sometimes also with the common silurus (*S. glanis* L.) and the dwarf silurus (*Amiurus nebulosus* Günth.) and *Microp-terus salmonides*. The last three only play an accessory part and constitute the smallest part of the mass of the essential species. Generally, fishing takes place after 3 years but of late years fishing after 2 years has become more common. Favourable conditions of soil and climate as well as moderate feeding enable fish of 2.2 to 3.3 lbs. to be obtained in 2 years, thus enabling the increasing demands to be met. The majority of the ponds are also used for the artificial rearing of fish. Maize and barley are the chief food but rye, beans, lupins and even meat meal and fish meal are also used. Very satisfactory results have been obtained and this method of feeding is rapidly spreading.

Pisciculture in Hungary is an important factor in the increase of national wealth. This is shown by the fact that at the end of 1913 the intensive working of the fish ponds was practised in 210 localities on an area of 29 025 acres of which about one half consists of artificial ponds with a discharge system and the other half of natural ponds which can only be partially dried up. The annual value of the products of these ponds exceeds £148 000 sterling. The Government encourage the formation of ponds and employs experts to make the plans and estimates, etc., and later to control the construction and working. It also favours the restocking of natural ponds by placing the necessary eggs and fry at the disposition of the communes and small holders, and supplies all information free. By this means the initial difficulties were overcome and success assured, so much so that big commercial concerns have taken up the industry. Thus, for the development of the vast area of water known as Lake Balaton, the Lake Balaton Fishing Company Ltd. was formed at Siofok in 1890 and for fish rearing on a large scale the Fish Rearers Society Ltd, was formed at Budapest.

*State Institutions.* — The Royal Hungarian Fishing Inspectorate established in 1883 at the Ministry of Agriculture is a bureau which has been acting in a technical capacity since the foundation of the fishing societies and sees that the working of the societies conforms to the law, orders, statutes and plans of working etc. It is also charged with supplying gratuitously to individuals and societies who make application to the Minister of Agriculture, technical advice, local investigations, plans, the direction and supervision of works and the management of forests. The staff is composed of trained experts assisted by master fishermen. These subalterns take a general course of study at the Royal School of Water Masters, and complete their instruction by a practical course under the Inspectorate. They are especially appointed to the control of works under execution and the working of fish ponds.

The Royal Station of Pisciculture and Water Purification of Budapest is occupied with the theory and practice of fish and crayfish breeding. According to the rules of its organisation its work is as follows :

1) to determine the conditions of life of the fish and crayfish and the vegetable and animal organisms upon which they feed ;

2) the study of the rational feeding of fish and crayfish by means of systematic experiments;

3) the valuation and improvement of fish ponds;

4) researches on the poisonous effects of organic and inorganic matter on aquatic animals;

5) the determination of the cause and degree of mortality due to the pollution of public waters;

6) the study of the methods and processes for the purification (1) of foul waters from sewers and industrial works, the careful observation of the results obtained and to give advice and information to authorities and individuals on questions relating thereto;

7) the control of industrial firms so that they conform to the law with regard to the purification of their polluted waters;

8) the study of the diseases of fish and crayfish caused by physical or chemical agents, when appearing in an acute form.

The Station gives free information so far as its technical advice can be given without special examination. Its services are gratuitous in cases of public interest whilst in other cases a fixed charge is made, the proceeds of which go to the Treasury. The staff consists of chemists and biologists.

The " Station of Piscicultural Pathology " which is a branch of the Royal Veterinary School works conjointly with the Institute of Pathological Anatomy. Its object is the study of fish hygiene, the spread of diseases, preventive measures and everything which may act injuriously on the multiplication and development of fishes and crayfish. Diseased fish are examined gratuitously by the station.

Besides these institutions, the disinterested work of which constitutes a praiseworthy encouragement by the State, there is also the free distribution of eggs and fry by the State, the numbers of which distributed during the 10 years 1903 to 1913 are as follows: (in thousands).

| Year. | Eggs of *Trutta fario* L. | Eggs of *Salmo irideus* Gibb. | Eggs of *Lucioperca sandra* Tur. | Fry of *Cyprinus carpio* L. | Larvae of *Astacus fluviatilis.* |
|---|---|---|---|---|---|
| 1903 . . . . . | 1 750 | 1 300 | 45 380 | — | — |
| 1904 . . . . . | 1 870 | 1 340 | 56 000 | — | 30 |
| 1905 . . . . . | 2 200 | 1 340 | 56 000 | — | 30 |
| 1906 . . . . . | 2 200 | 1 500 | 56 000 | 336 | 50 |
| 1907 . . . . . | 2 400 | 1 660 | 62 000 | 80 | 50 |
| 1908 . . . . . | 2 500 | 1 780 | 64 000 | 90 | 55 |
| 1909 . . . . . | 2 800 | 1 780 | 62 000 | 43.2 | 62 |
| 1910 . . . . . | 2 700 | 1 750 | 64 000 | 700 | 70 |
| 1911 . . . . . | 2 900 | 2 000 | 60 000 | 300 | 47 |
| 1912 . . . . . | 3 900 | 2 000 | 70 000 | 70 | 40 |
| 1913 . . . . . | 3 400 | 2 000 | 70 000 | 75 | 42. |

(1) See also *B.* Feb. 1915, No. 211. (*Ed.*).

It should be noted that this reproductive material was exclusively of local origin.

In order to meet practical needs the Ministry of Agriculture publishes bimonthly a purely technical journal known as " Halászat " or " Fishing " which is issued gratuitously or at a very low price. In addition to that of diffusing technical knowledge this journal is published to rouse public interest and to direct the activities of those interested.

There are also bursaries of 300 crowns (about 12 guineas) given by the State to fishermen who undertake practical studies with a view to attaining proficiency in pisciculture.

In completion of what has been cited above a summary of the State expenses for pisciculture is given for several years:

| Years | £ |
|---|---|
| 1889 | 3 246 |
| 1904 | 5 164 |
| 1909 | 8 225 |
| 1914-1915 | 10 328 |

Mention should be made, as a private concern, of the " National Society of Pisciculture " at Budapest which deals successfully with all questions relating to fishing and the organisation of exhibitions.

*Commerce.* — It has only been possible to speak of a fish trade since a reliable supply has been made available by the radical transformation of the industry. So long as the requirements of consumers were only satisfied by the products from natural waters the commercial movement was restricted to a very limited number of markets in towns by the rivers. The greatest fish market in Hungary is Budapest whither some 40 000 tons of fresh water fish are sent annually.

The markets have no facilities for the storing of the produce, a fact which tends to a continual fluctuation in price. With the object of improving the conditions of sale of the artificially reared fish, the State arranges for the establishment of reserwirs at certain towns supplied with running water and capable of storing large quantities of fish. Already, in certain towns, neighbouring fish breeders are so organised as to be able to satisfy the requirements of the markets. Nevertheless the price still remains too high for the fish to attain its former popularity as a food. Although the country does not produce sufficient for national requirements a considerable amount is exported to Austria and Germany thus helping to maintain the high prices at home. In the writer's opinion these conditions justify the active intervention of the State more especially as nothing is lacking for the creation of an important industry.

SECOND PART.

# ABSTRACTS

## AGRICULTURAL INTELLIGENCE

### GENERAL INFORMATION.

RURAL HYGIENE

137 – **Biological Studies on the House Fly** (1). — ROUBAND, E., in *Comptes-Rendus hebdomadaires des Séances de la Société de Biologie*, Vol. LXXVIII, No. 18, pp. 615-616. Paris, December 3, 1915.

The writer continues his studies on the housefly with the object of determining the constituents of horse dung favourable to the deposition of the eggs. He has shown that in the unmixed dung and urine soaked litter of cattle, goats, pigs rabbits and guinea pigs the eggs of the house fly do not appear to be deposited.

These excreta however may become suitable material for the development of flies after the addition of such a secondary fermenting substance as wheat bran. Thus feeding wheat bran to animals renders their dung liable to infestation with the larvae. Also mixing cow dung with horse dung as is frequently done in the country districts promotes the development of the larvae. The writer has already suggested a simple method of destroying the larvae of fresh horse dung by burying it in the centre of a mass of old fermented dung. This method may be still further simplified if the horse dung is removed from the stalls every day. In this case it only contains the eggs of the fly and these are easily killed at 46° C. by the heat of fermentation. It is sufficient to place this fresh manure in a hollow in the top of the old dung heap easily made by means of a rake. With this simple procedure the heat of fermentation rapidly extend to the fresh dung, thus sterilizing the eggs. Before each addition of fresh dung to the heap the surface of the

(1) See *B.* Nov. 1915, No. 116. (*Ed.*).

ermenting dung is raked together and placed in contact with the hotter nterior along with the fresh dung. It is better to carry out these operations later in the same day rather than the following morning, thus preenting the eggs from hatching during the night.

38 - **A Case of Septicœmia in Man produced by *Streptococcus equinus* in the Anglo Egyptian Sudan.** — CHALMERS, A. J. (Director Welcome Tropical Research Laboratories) and HADDAD, GEORGE, in *The Journal of Tropical Medicine and Hygiene*, Vol. XVIII, No. 23, pp. 265-266. London, December 1, 1915.

A fatal case of Septicœmia is recorded in a young Sudanese of 20 years, aused by *Streptococcus equinus* (described by Andrewes and Horder in 906). Probably the infection took place from horse dung through a vound. *S. equinus* was obtained in pure culture from the venous blood f the victim.

This is the first record of *S. equinus* pathogenic in man and of its occurence in tropical countries.

39 - **A Relative Score Method of Recording Comparisons of Plant Condition and other Unmeasured Characters.** — FREE, E. F. (The John Hopkins University, Baltimore) in *The Plant World*, Vol. 18, No. 9, pp. 249-256. Baltimore, Md., September 1915.

ORGANISATION OF EXPERIMENTAL AND ANALYTICAL WORK

The lack of means of expressing more or less quantitatively, relations vhich are not strictly commensurable, results in the adoption of a method f simple comparison which, though not involving serious error in the ase of a limited number, becomes very troublesome and faulty when many lants are to be considered or when non-simultaneous series are to be compared. Two methods are in vogue for avoding these difficulties, viz.: ) rough classification into excellent, good, fair, poor, etc.; 2) arranging the lants in order of merit and assigning numerical values according to an rbitrary scale.

Both these methods suffer from the inherent difficulty of being dependent for accuracy upon the observer retaining constantly in mind the characters and condition of all plants of the series at the same time. This is not only difficult but practically impossible when hundreds of plants have to be dealt with.

The writer has overcome this difficulty by the use of a method derived rom that used by psychologists in the investigation of affections and which enables the formalisation and partial quantitative expression of comparative udgments formed upon any criteria whatsoever.

The essence of the method consists in comparing the individuals of the series in pairs, recording the result of each comparison and the subsequent summation of the comparisons of each pair of individuals. The result is therefore a record of individual comparisons of each plant with each other plant and of the judgment formed in each case. This is reduced to quantitative terms by adding together the scores given to each plant in the course of the comparison.

The method may be illustrated as follows in which 8 plants are compared as to their general health and condition. Sixty four squares are ruled on a sheet of paper, the numbers of the last seven plants being set

down in the upper margin and the numbers of the first seven in the left hand margin. Plant number 1 is then compared with plant number 2 as to their relative condition — all other plants in the series being neglected. If i

| | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 3 | 4 | 5 | 6 | 7 | 8 |
| 2 | | 3 | 4 | 5 | 6 | 7 | 8 |
| 3 | | | 3 | 5 | 6 | 7 | 8 |
| 4 | | | | 5 | 6 | 7 | 8 |
| 5 | | | | | 5 | 5 | 8 |
| 6 | | | | | | a | 8 |
| 7 | | | | | | | 8 |

is judged that plant number 1 is better a figure 1 is placed in the square corresponding to plant number 1 on the left and plant number 2 on the top. Proceeding, the comparison of plant number 1 with plant number 3 leads to a judgement that number 3 is better and a number 3 is entered in the corresponding square. Similar comparisons of plant number 1 are made with plants numbers 4, 5, 6, 7 and 8, after which a fresh series is begun by comparing plant number 2 with each other plant. In this way a series of comparisons in made with each plant number. In case no difference is detected a letter *a* is entered in the square thus counting as no score for either plant. Adding up the scores we get the table on page 191.

A graph is then constructed by plotting these numbers as ordinates and the numbers of the plants as abscissae.

Small differences betwen individual plants can be taken into account by under-scoring or over-scoring the figures entered in each case and giving each score a valuation ranging from 1 to 3 or 5 according to the accuracy desired.

By means of this scheme the writer has been able to obtain comparisons of such diverse things as chemical precipitates, degree of flocculation of clay suspensions, relative ruggedness of mountain ranges, thickness of stand of vegetation, adhesiveness of wall-paper to different plasters, etc.

| Plant Number . . . . . | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Scores | 1 | | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | 1 | | 1 | 1 | 1 | 1 |
| | | | | | 1 | 1 | 1 | 1 |
| | | | | | 1 | | | 1 |
| | | | | | 1 | | | 1 |
| | | | | | | | | 1 |
| Totals . . . | 1 | 0 | 3 | 2 | 6 | 4 | 4 | 7 |

It should be emphasised that this method is nothing more than a system of facilitating, recording and formalising judgement, its accuracy depending upon the correctness of the individual judgements.

## CROPS AND CULTIVATION.

40 – **Relation between Humidity and Yield of Winter Wheat in Western Kansas, United States.** — CALL, L. E. and HALLSTED, A. L., in *Agricultural Experiment Station, Kansas State Agricultural College, Bulletin* No. 206, pp. 1-34. Manhattan, 1915. AGRICULTURAL METEOROLOGY

In Western Kansas moisture is the limiting factor in the production of wheat. The soil of this region is deep, rich in plant food and very fertile when the necessary moisture for plant growth is present. According to the records of the Hays Observatory the mean annual rainfall in Kansas is 23 inches, which would be sufficient for an abundant yield if well distributed. Most of this rain falls in the period April to September, whilst in the latter part of autumn, in winter and in spring rain is very scarce. Thus all measures for accumulating and storing water in the soil are important.

In these experiments three different methods of preparing the seed bed were tried, viz :

1) *Late-autumn cultivation.* — Effected a few days before sowing and to a depth of 4 inches.

2) *Early-autumn cultivation.* — Effected soon after harvest and to a depth of 7 inches.

3) *Summer fallowing.* — Single cropping is replaced by a rotation wheat-leguminous crop or wheat-sorghum.

The adjacent table shows the relation between the available moisture at sowing-time, the manner of preparation, the rainfall and the yield.

| | Year | Percentage humidity available at sowing-time | Total rainfall in inches during growth period | Yield of | |
|---|---|---|---|---|---|
| | | | | Grain in bushels | Straw in pounds |
| Late Autumn Ploughing | 1910 | 5.9 | 12.41 | 20.03 | 2 985 |
| | 1911 | 1.7 | 6.04 | — | — |
| | 1912 | 0.9 | 15.57 | 2.3 | 265 |
| | 1913 | 2.2 | 15.24 | 0.8 | 815 |
| | Mean | 2.7 | 12.32 | 5.9 | 1 015 |
| Early Autumn Ploughing | 1910 | 7.2 | 12.41 | 27.8 | 3 135 |
| | 1911 | 3.8 | 6.04 | 0.3 | 80 |
| | 1912 | 2.7 | 15.57 | 13.8 | 3 425 |
| | 1913 | 3.1 | 15.24 | 2.3 | — |
| | Mean | 4.2 | 12.32 | 11.1 | 1 978 |
| Summer fallowing | 1910 | 10.8 | 12.41 | 42.5 | 4 845 |
| | 1911 | 9.2 | 6.04 | 2.6 | 795 |
| | 1912 | 5.5 | 15.57 | 29.2 | 5 240 |
| | 1913 | 9.8 | 15.24 | 10.3 | 3 245 |
| | Mean | 8.8 | 12.32 | 21.2 | 3 531 |

Considering the average results of the four years :

After cultivation at the end of autumn there was 2.7 per cent of avail able moisture at the period of sowing ; after early autumn cultivation th available moisture was 4.2 per cent and after fallow 8.8 per cent. Witl 2.7 per cent of available moisture the average yield was 5.9 bushels pe acre ; with 4.2 per cent it was 11.1 bushels per acre and with 8.8 per cen it was 21.2 bushels per acre.

The yield is therefore in direct relation with the quantity of moistur in the soil available at the time of sowing.

141 - **The Frequency of Low Temperatures at Vercelli (Italy) and its Effect on th Cultivation of Rice.** — MARCARELLI, B., in *Giornale di Risicultura*, Year V, No. 22 pp. 355-360. Fig. 1, Vercelli, 1915.

The maximum temperature limits for the cultivation of rice are unknow in Italy whilst the minimum temperature limits are of great importance i the early stages of the rice crop. The resistance of the stems does not g below 46° to 50 F° C., and at lower temperatures the tender leaves and par

icularly the apical bud are partially arrested in growth according to the ntensity of the cold followed by a yellowing of the greener parts of the stem.

Observations on the growth rate of rice have shown that the maximum ate of growth does not correspond to the maximum temperature but rather to the highest minimum temperature associated with warm, short nights.

In Italy the highest minimum temperatures occur in July and the first week of August when the humidity of the air is relatively high and the days ong and very warm, so that the irrigation water prevents the morning temperature from falling below 59° F. During the last days of July and the first days of September of 1915 there was a considerable lowering of temperature in the Vercelli districts causing considerable damage to the rice crops. For the majority of rices cultivated near Vercelli this period coincides with the most delicate and important stages in the growth of the plants, viz: the development of the ear, inflorescence and grain. Some of the plants produced erect spikes with few lateral branches and without grain or only with shrivelled diseased grain of a dirty white colour, showing that the first change in the grain of rice due to a sudden lowering of temperature during its development is a gradual decrease in all its functional activities, followed by an arrest of growth and failure to mature. In the case of the inflorescence the effect is more obvious in the wrinkling of the glumes and atrophy of the organs of reproduction.

Since the probability of cold nights and sudden changes of temperature is fairly considerable at Vercelli towards the end of August and beginning of September, late varieties cannot be grown without risk. Also in the case of Japanese rices it is desirable to choose early maturing varieties.

142 – **Influence of Growth of Cowpeas upon some Physical, Chemical and Biological Properties of Soil.** — LE CLAIR, C. A. (Assistant Professor of Soils, University of Missouri) in *Journal of Agricultural Research*, Vol. V, No. 10, pp. 439-447, Plate XLI. Washington, December 1915.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

Some authorities have expressed the belief that cowpeas are capable of producing a loosening effect upon the soil, but no authentic data are available. These experiments were carried out at the Missouri Experiment Station to test this theory. The soil used was a silt loam. The main point at issue was the study of the soil compactness and nitrate content of the plots in relation to various treatments. Five plots were used and treated as follows:

Plot D. unploughed and kept clean.
" E. unploughed and planted with cowpeas.
" F. ploughed and planted with cowpeas.
" G. ploughed, artificially shaded and kept clean.
" H. ploughed, kept clean without either shade or cowpeas.

The artificial shade was erected on plot G. at a time when the cowpeas on plots E and F were matting over the soil. The shading device consisted of a thin piece of black cheese-cloth stretched over a galvanised wire screen

supported by four legs. It was found sufficient to shade the soil from the direct rays of the sun without unduly impeding the rain.

The compactness of the soil was determined by counting the number of times a weighted ram had to be dropped from a specified height in order that a conical pin might be driven a given distance into the soil. Fifteen determinations were made for each plot and averaged. The results were checked by determination of the apparent specific gravity by Wolling's method and the same ratio was found to hold in each case thus showing that the compactness device is an accurate method of measuring soil friability. The average results for the relative compactness of the soil of the various plots are as follows :

| | D. (unploughed; clean) | E. (unploughed; cowpeas) | F. (ploughed; cowpeas) | G. (ploughed; artificial shade) | H. (ploughed; clean) |
|---|---|---|---|---|---|
| June 19, 1912 . . . . | 13.3 | 10.5 | 3.6 | 3.4 | 3.6 |
| October 15, 1912 . . . | 19.4 | 15.4 | 4.0 | 5.9 | 6.0 |

Thus the increase in compactness of the soil during the experiment was greatest on the unploughed plots and least on the ploughed plot covered with cowpeas.

Determination of the moisture content of the soils at different depths showed that more moisture was lost from the cowpea plots, but in this case it is drawn from the 3rd and 4th foot of soil, the surface soil of these plots containing more water than that of the uncropped plots. Plot H (ploughed, clean) showed the greatest loss of water from the surface soil and comparing this with plot G (ploughed and shaded) which lost much less water than plot H it appears that the presence of moisture alone is not sufficient to account for the permanence of the friability of the cropped plots.

Bacterial examination of the soil showed that the cropped plots contained greater numbers of bacteria than the uncropped plots, but no correlation could be drawn from the determinations of the nitrifying and ammonifying efficiencies of the various plots.

It is concluded that the factors concerned in preventing the packing of soil upon which cowpeas are grown are 1) the bacterial activity causing a greater production of active humus, and 2) the mechanical effect of shade of the crop in reducing the evaporation from the surface layers.

143 – **A Soil Sampler for Soil Bacteriologists** (Society of American Bacteriologists, V, Industrial Bacteriology). — Noyes H. A. in *Science*, N. S., Vol. XLII, No. 1079, p. 317. Lancaster, Pa., 1915.

The object of this sampler is to furnish a piece of apparatus which will sample the soil under one system of cultivation as well as under another. It also becomes the container for the soil after the sample is taken.

The sampler is a brass tube 11 inches long, with one end made into

a cutting edge. This cutting edge is so made that the soil is not appreciably compacted when the sample is taken. The end having the cutting edge is furnished with a tight fitting brass cap two inches in height. The open end, plugged with absorbent cotton, makes the sampler complete. The procedure in using this apparatus is as follows: Plug and cap as many samplers as you wish to take samples of soil; sterilize them in the hot air sterilizer and take them to the field. Remove a cap from a sampler, insert the driving head above the cotton plug and drive the sampler into the ground to the desired depth, pull it out, flame and return the cap and the sample is ready to take to the laboratory.

The sampler has the following properties which are important in bacteriological work: Easily sterilized; easily kept clean; easily manipulated; durable.

1144 – **The Effect of Phosphates and Sulphates on Soil Bacteria** (Society of American Bacteriologists, V., Industrial Bacteriology). — FRED, E. B., in *Science*, N. S., Vol. XLII, No. 1079, pp. 317-318. Lancaster, Pa., 1915.

The influence of inorganic fertilizers on the bacterial processes of the soil has not received much attention. For this reason a study of the effect of some of the pure salts of those elements which constitute an important part of commercial fertilizers was undertaken. The aim was to determine, if possible, the influence of phosphates and sulphates upon the activities of soil bacteria and to ascertain if the fertilizing effect of these substances could be explained in part by the promotion of bacterial action.

The following methods were employed: Rate of ammonification in solution and in soil; this was conducted with pure and with mixed cultures of bacteria. Aside from this, determination was made of the relation of the number of cells to the amount of nitrogen ammonified. To show this relation, plate counts were used. The nitrogen for ammonification was added to the solution in the form of peptone and to soil in the form of casein. The rate at which the nitrogen of these substances is converted into ammonia was determined by distilling with magnesium oxide. The cultures were incubated at room temperature and at different intervals the amount of ammonia determined.

Monobasic potassium phosphate in peptone solution caused a great increase in the production of ammonia. This is noted with a pure-culture yellow ammonifier and with a suspension of soil bacteria. The gain was greatest at the end of the first two days. Merck's precipitated calcium phosphate caused a slight increase in ammonification, but not nearly so large as the monobasic potassium phosphate. Sulphates of calcium and potassium increased ammonification to a small extent. The action of monobasic potassium phosphate was far greater than that of potassium sulphate. From this it seems that the potassium ion does not materialy influence ammonification. The results of plate counts show that monobasic potassium phosphate causes an enormous increase in multiplication of bacteria. This is followed by a rise in ammonia. The ammonia production, however, is not in proportion to the number of bacteria. This seems rather

to be a result of increase in the number of cells than increase in individua cell activity. All of the phosphates gave a large increase in the numbe of soil bacteria. There was only a slight increase from the sulphates. Th same relative effect of phosphates and sulphates was noted in the case o carbon-dioxide evolution.

From the results of this work, as a whole, the following conclusio may be drawn : That possibly the increased crop production which re sults from the application of soluble phosphates is due in part to the pro motion of bacterial activity.

145 – **Relation of Lime to Production of Nitrates and Mineral Nitrogen** (Society o American Bacteriologists, V, Industrial Bacteriology). — SCALES, F. M. in *Science* N. S., Vol. XLII, No. 1079, p. 317. Lancaster, Pa., 1915.

The lime requirement of an acid soil was determined by adding varying quantities of calcium carbonate to weighed portions of the soil, moistening and, after an hour, testing with litmus paper until a quantity was found that gave a neutral reaction. The lime requirement by the Veitch method was the same as the above. Fractions and multiples of this requirement were added to 100 gm. portions of soil which received in addition for one duplicate set alfalfa powder. They were moistened with 18 per cent. of distilled water and incubated for three weeks at 28° to 30° C. Determinations of nitrate and mineral nitrogen present in the samples showed that the nitrifying bacteria were most active in the presence of 50 per cent. of the calcium carbonate requirement and the ammonifying and nitrifying groups combined in the presence of 75 per cent. of the amount required according to the chemical determinations. In this particular soil an excess of calcium carbonate was markedly toxic for the nitrifying organisms and not stimulating for the ammonifiers.

TILLAGE AND METHODS OF CULTIVATION

146 – **Methods of Soil Sterilisation for Plant Beds and Greenhouses.** — SELBY A. D. and HUMBERT J. G. in *Ohio Agricultural Experiment Station, Circular* No. 151, pp. 65-74. Wooster, Ohio January 15, 1915.

The writer describes three methods of soil sterilisation in use in Ohio State, *viz* : 1. the perforated pipe method : 2. the inverted pan method : and 3. the formalin drench method.

The particular method in use varies according the greenhouse conditions and type of soil used. Light soils and those rich in humus are more suitable to the pan method, the apparatus of which consists of a galvanised iron pan 6 × 10 feet and 6 inches deep inverted over the soil and heated with steam under pressure.

In the formalin method a 6 per cent solution of formalin (40 per cent) is applied at the rate of 1 gallon per square foot and the soil stirred every few days to rid the soil of fumes poisonous to young plants. This method is the most expensive in actual cost of treatment, but less exacting in the apparatus.

147 – **Green-manuring in the Central Provinces, India.** — Allan, R. G. (Principal, Agricultural College, Nagpur.) in *The Agricultural Journal of India*, Vol. X, Part IV, pp. 380-394. Calcutta, October 1915.

The climate of the Central Provinces is characterised by a rainfall of 40 inches compressed into the period between June 15 and September 15, not infrequently beginning later and stopping earlier. Under these conditions the problem of green manuring is a very difficult one.

The plants used for this purpose are: Dhaincha (*Sesbania*), San (*Crotalaria juncea*), Tarota (*Cassia occidentalis*), Bawchi (*Psoralea corylifolia*), Kulthi (*Dolichos unifforus*), wild indigo (*Vernonia cinerea*).

Except in the case of paddy green manure generally precedes a winter crop almost invariably wheat. In the case of paddy *san* and *dhaincha* are used, the former having the advantage of a more rapid growth. Burying of the green manure takes place just before transplanting. Experiments during 1911 to 1914 showed an average increase of 223 lbs of grain per acre for the plots manured with *san* and 203 lbs for the *dhaincha* plots. When the monsoon arrives late the green manure crop suffers but no advantage is obtained by postponing ploughing to a later date, late transplantation of the paddy being more serious than a decreased quantity of organic manure.

Experiments on plots manured with artificials emphasised the value of phosphates and also of calcium cyanamide, in conjunction with *san*. On irrigated plots the increase due to phosphates (bone dust) was increased from 132 lbs to 496 lbs per acre, and on the plots without irrigation the increase was raised from 144 lbs to 631 lbs per acre owing to manuring with *san*. The phosphatic manure is best applied at the time of sowing the green manure crop.

Experiments on green manuring for the wheat crop carried out for a long period of years have given results supporting the following conclusions:

*a*) earliness of ploughing in the green manure is more important than quantity of manure;

*b*) success is improbable unless at least 12 inches, or better, 16 inches of rain is received after ploughing in and before sowing. Ploughing should therefore be done by the first week in August, so that a quick crop like *san* should be used or weeds collected on the field;

*c*) when irrigation is available, either early sowing of the green crop is advisable, or, if the rainfall falls below the minimum of 9 inches, irrigation applied before sowing the wheat to promote the decomposition of the manure.

*d*) in areas where a rainfall of 12 inches after August 1st. cannot be relied on, increased fertility can be obtained by feeding animals with a leguminous crop during the monsoon. In this case the stubble should be inverted by mid-August. A rainfall of 6 or 7 inches is sufficient after this treatment. Unless the increased fertility is essential a cultivated summer fallow is probably a safer practice.

*e*) in areas with a total monsoon rainfall less than 35 inches, green manuring for a winter crop is practically out of the question.

148 - **Experiments in Java with Green Manures.** — VAN HELTEN, W. M., in *Mededeelingen uit den Cultuurtuin*, No. 2, 32 pp., 4 plates and 2 Tables. Buitenzorg, 1915.

The writer describes a number of plants (amongst others, *Tephrosia candida, T. hookeriana var. amoena*, and *T. vogelii*; *Centrosema plumieri*; *Clitoria cajanifolia*; *Desmodium gyroides*; *Indigofera hirsuta* and *I. sumatrana*, and *Crotalaria striata*) which gave excellent results when used as green manure in the Experiment Garden at Buitenzorg, especially after the alang alang (*Imperata* sp.) and weeds had been previously uprooted.

The experiments carried out at the Experiment Garden of Buitenzorg and in the plantations of Java brought out the following points:

*Tephrosia candida* gave better results than the other plants used as green manure, especially in the hevea, cacao and tea plantations.

*Clitoria cajanifolia* can be recommended as preventing erosion on sloping ground.

*Cassia pumila* rapidly covers the ground and produces abundant foliage, it is to be recommended for young plantations of rubber trees and of tea shrubs, in order to prevent erosion and the spread of weeds

*Cassia tora* has a subfrutescent habit and grows as well on the seaboard as in the mountains.

The writer advises that the experiments should be continued with *Tephrosia* sp., *Crotalaria muyussi, Desmodium hirsutum* and *Indigofera villosa* by manuring crops other than those growing in the Buitenzorg Experiment Garden.

149 - **Experiments in Germany on the Effect of the Phosphoric Acid contained in Different Kinds of Basic Slag.** — TACKE, GERLACH, SCHNEIDERWEID, HASELHOFF, EBERHARDT, in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. 87, Nos. 2 and 3, pp.89-160. Berlin, October 21, 1915.

The very careful experiments made by the writers with different kinds of basic slag have proved that the effect of the slag is independent of the amount of fine particles contained and of the alkalinity, but is in close connection with the content of phosphoric acid soluble in citric acid. Some slags, however, behave a little differently.

150 - **The Relation of Sulphur to Soil Fertility.** — SHEDD, O. M., in *Kentucky Agricultural Experiment Station, Bulletin* No. 188, pp. 595-630. Lexington, Ky., December 1914.

Numerous experiments have been made in the last few years in determining the importance of sulphur compounds in plant growth and their value in soil fertility.

The writer has determined the percentage of sulphur for a large number of plants, and has found that several among these contain relatively high amounts of this element. Among 31 varieties of tobacco analysed, 2 only contained less amounts of sulphur than of phosphorus, while the large majority contained considerably more, the sulphur in some cases being about double the phosphorus. The average content of sulphur was 0.458 % and that of phosphorus 0.302 %.

In order to determine the effect of sulphur on the growth of certain plants the writer has carried out a series of greenhouse experiments by adding sulphur or its compounds to the soil. The first plant tested was Yel-

low Pryor tobacco, 250 seeds of which were planted in each of the boxes filled with 15 lbs. of superficial soil taken from not very fertile ground containing 240 lbs. of sulphur and 860 lbs. of phosphorus per acre (assuming one acre of the soil, six inches deep, to weigh 1 500 000 lbs.; all the quantities of the fertilizers are calculated on this basis). The order of the test and its results are given in Table I. When the largest plants had reached the transplanting stage, all were cut close to the ground and immediately weighed.

TABLE I. — *Plan and results of the 1st series of experiments.*

| Number of pot | Substance added per acre | Weight in grams of the cut portion of the plants |
|---|---|---|
| 1 | Nothing added . . . . . | 21 |
| 2 | 100 lbs. sulphur per acre . . . . . | 11 |
| 3 | 500 » » » » . . . . . | 5 |
| 4 | 536 » gypsum » containing 100 lbs. sulphur . . . . . | 4 |
| 5 | 200 lbs. potassium nitrate per acre . . . 500 » calcium phospate (secondary) per acre 500 » calcium carbonate per acre . . . . | 88 |
| 6 | Same as No. 5 + 100 lbs. sulphur per acre . | 97 *i. e.* 10 % gain over check No. 5 |
| 7 | » » » » + 500 » » » » . | 109 » 24 % » » » » |
| 8 | » » » » + 536 » gypsum . . . . . | 109 » 24 % » » » » |

The addition of sulphur or gypsum in conjunction with the other elements and calcium carbonate, has evidently had for this soil a stimulating effect on the growth of the tobacco plants.

In a 2nd series of experiments the soil used was taken from poor ground containing 600 lbs. of sulphur and 3 040 lbs. of phosphorus per acre (assuming the top seven inches of soil as weighing 2 000 000 lbs. per acre). The soil was sifted and calcium carbonate added at the rate of 4000 lbs.per acre. The other substances added are given in Table II. Sixteen pounds of the air-dried soil thus prepared were put in two-gallon stone jars, 10 soy bean seeds were planted in each jar which were afterwards thinned to 6 average size plants. After the pods were matured, the plants were cut close to the ground, and weighed. The total sulphur and protein in the grains produced was also determined. After cutting the soy beans, the soil of the pots was put through a coarse sieve to remove the roots, then replaced in the pots. In each pot 20 Purple Top turnip seeds were planted, which were afterwards thinned to 4 average size plants in each jar. When harvested the turnips, tops and roots, were weighed. The result of the 2 harvests are given in Table II. In several cases good results in the growth of soy beans were obtained with sulphur compounds,

TABLE II. — *Order and results of the 2nd series of experiments.*

| Number of jars | Substance added in pounds per acre | Soy beans | | | | | | Turnips | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Weight in grams Tops and Seed | Per cent increase over checks | Weight in grams Seed | Per cent increase over checks | Per cent Protein | Per cent Sulphur | Weight in grams Tops | Per cent increase over checks | Weight in grams Roots | Per cent increase over checks |
| 1 | Iron disulphide (pyrite) . 11 | 11.37 | 20 | 1.02 | — 0,5 | 14.47 | 0.235 | 25 | 25 | 100 | 117 |
| 2 *a* | Ferrous sulphate (copperas) 52 | 10.92 | 19 | 1.56 | 51 | 14.38 | 0.131 | 25 | 25 | 85 | 114 |
| 2 *b* | » » » » | 11.58 | | 1.54 | | 13.56 | 0.107 | 25 | | 112 | |
| 3 *a* | Ammonium sulphate . . 412 | 15.10 | 27 | 2.26 | 60 | 21.50 | 0.073 | 26 | 32 | 97 | 77 |
| 3 *b* | » » . . » | 8.98 | | 1.03 | | 23.63 | 0.220 | 27 | | 66 | |
| 4 *a* | Calcium sulphate (gypsum) 602 | 11.62 | 14 | 1.16 | 18 | 13.94 | 0.073 | 19 | 42 | 57 | 94 |
| 4 *b* | » » » » | 9.99 | | 1.26 | | 16.72 | 0.209 | 38 | | 94 | |
| 5 *a* | Potassium sulphate . . . 609 | 8.61 | 9 | 1.04 | 59 | 17.78 | 0.085 | 24 | — 7 | 40 | — 12 |
| 5 *b* | » » . . . » | 12.04 | | 2.23 | | 14.35 | 0.231 | 13 | | 41 | |
| 6 *a* | Barium » . . . 728 | 11.05 | 8 | 1.72 | 55 | 13.63 | 0.073 | 37 | 40 | 115 | 71 |
| 6 *b* | » . . . . . » | 9.27 | | 1.45 | | 15.10 | 0.205 | 19 | | 42 | |
| 7 *a* | Magnesium sulphate . . . 769 | 9.02 | 12 | 1.26 | 38 | 16.47 | 0.088 | 18 | — 10 | 30 | — 9 |
| 7 *b* | » . . . . . » | 12.06 | | 1.56 | | 13.13 | 0.236 | 18 | | 54 | |
| 8 *a* | Aluminum sulphate . . . 693 | 12.11 | 15 | 2.13 | 77 | 12.13 | 0.142 | 31 | 42 | 83 | 66 |
| 8 *b* | » . . . . . » | 9.61 | | 1.49 | | 13.81 | 0.172 | 26 | | 70 | |
| 9 *a* | Sodium sulphate . . . . 443 | 11.62 | 11 | 1.63 | 38 | 12.53 | 0.080 | 34 | 67 | 74 | 72 |
| 9 *b* | » . . . . . » | 9.36 | | 1.21 | | 14.72 | 0.203 | 33 | | 84 | |
| 10 *a* | Flowers of sulphur . . . . 100 | 12.27 | 31 | 1.47 | 72 | 12.25 | 0.195 | 25 | 22 | 77 | 45 |
| 10 *b* | » » » . . . » | 12.45 | | 2.05 | | 12.50 | 0.185 | 24 | | 56 | |
| 11 *a* | Nothing added but $CaCO_3$ . . . | 9.63 | | 1.06 | | 17.56 | 0.085 | 22 | | 50 | |
| 11 *b* | » » » » » | 9.25 | | 0.99 | | 15.10 | 0.098 | 18 | | 42 | |

but those obtained by the element sulphur were the best. The percentage of sulphur has been increased in the soy beans which had sulphur compounds added but this is not the case for the percentage of protein. The growth of the turnips was also considerably influenced by the sulphur fertilization.

The soil used in the 3rd. series of experiments on the effets of sulphates on red clover was taken from the same ground as that used for the 2nd. series and had calcium carbonate added to it at the rate of 4000 lbs. per acre. The other substances added are give in Table III. In each jar were planted 25 red clover seeds, which were afterwards thinned to 12 average size plants in each jar. Cuttings of the clover plants about one inch from the crown were made at intervals whenever the plant attained a height of about six inches. Four cuttings were made. The air-dried weights of these are given in Table III. The effects of sulphates on red clover gave no gain except in the case of potassium sulphate when the gain was probably due to the presence of potassium.

TABLE III. — *Order and results of the 3rd series of experiments.*

| Number of Pots | Substance added in pounds per acre | Weight in grams of clover Total of 4 cuttings |
|---|---|---|
| 1 | Iron disulphide (pyrite) . . . . . 11 | 28.25 |
| 2 a | Ferrous sulphate (copperas) . . . . 52 | 29.96 |
| 2 b | » » » . . . . » | 31.44 |
| 3 a | Ammonium sulphate . . . . . 412 | 28.05 |
| 3 b | » » . . . . . » | 29.90 |
| 4 a | Calcium sulphate . . . . . 537 | 35.28 |
| 4 b | » » . . . . . » | 33.16 |
| 5 a | Potassium sulphate . . . . . 543 | 40.42 |
| 5 b | » » . . . . . » | 39.03 |
| 6 a | Barium » . . . . . 728 | 30.36 |
| 6 b | » . . . . . » | 29.19 |
| 7 a | Magnesium sulphate . . . . . 769 | 31.14 |
| 7 b | » . . . . . » | 34.15 |
| 8 a | Aluminum sulpha(e . . . . . 693 | 30.86 |
| 8 b | » . . . . . » | 28.05 |
| 9 a | Sodium sulphate . . . . . 443 | 35.95 |
| 9 b | » . . . . . » | 31.50 |
| 10 | » thiosulphate . . . . . 247 | 27.29 |
| 11 a | Flowers of sulphur . . . . . 100 | 35.91 |
| 11 b | » » » . . . . . » | 33.45 |
| 12 a | Nothing added but calcium carbonate . . | 33.12 |
| 12 b | » » » » » . . | 34.50 |

TABLE IV. — *Order and results of the 4th series of experiments,*

| Number of jars | Substance added in pounds per acre | Weight in grams of Cabbage plants | Per cent Gain or Loss | Weight in grams of Mustard plants | Per cent Gain or Loss | Weight of Radish plants in grams | | Per cent Gain or Loss | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Tops | Roots | Tops | Roots |
| 1 | Ferrous sulphide . . . . . 33 | 14.45 | — 1 | 3.75 | + 105 | 5 | 5 | — 37 | — 37 |
| 2 | Iron disulphide . . . . . 22 | 12.92 | — 11 | 3.59 | + 96 | 14 | 17 | + 75 | + 112 |
| 3 | Ferrous sulphate . . . . . 104 | 14.19 | — 3 | 2.35 | + 28 | 10 | 17 | + 25 | + 112 |
| 4 a | Ferric » . . . . . 50 | 13.06 | — 10 | 3.48 | + 90 | 12 | 18 | + 50 | + 125 |
| 4 b | » oxide . . . . . 26 | 14.83 | + 2 | 1.25 | — 32 | 6 | 4 | — 25 | — 50 |
| 5 a | Nickelous sulphate . . . . . 105 | 13.51 | — 7 | 2.22 | + 21 | 8 | 5 | 0 | — 37 |
| 5 b | » carbonate . . . . . 51 | 17.17 | + 18 | 1.50 | — 18 | 9 | 5 | + 12 | — 37 |
| 6 a | Cupric sulphate . . . . . 93 | 11.20 | — 23 | 2.44 | + 33 | 9 | 6 | + 12 | — 25 |
| 6 b | » carbonate . . . . . 46 | 16.86 | + 16 | 1.30 | — 29 | 6 | 4 | — 25 | — 50 |
| 7 a | Cobaltous sulphate . . . . . 105 | 12.48 | — 14 | 1.86 | + 2 | 8 | 8 | 0 | 0 |
| 7 b | » carbonate . . . . . 45 | 10.14 | — 30 | 1.45 | — 21 | 2 | 2 | — 75 | — 75 |
| 8 a | Chromic sulphate . . . . . 49 | 9.39 | — 36 | 2.86 | + 56 | 11 | 12 | + 37 | + 50 |
| 8 b | » carbonate . . . . . 36 | 12.05 | — 17 | 1.62 | — 11 | 7 | 3 | — 12 | — 62 |
| 9 a | Manganous sulphate . . . . . 83 | 11.91 | — 18 | 3.87 | + 111 | 9 | 8 | + 12 | 0 |
| 9 b | » carbonate . . . . . 43 | 11.02 | — 24 | 2.69 | + 47 | 11 | 15 | + 37 | + 87 |
| 10 a | Lithium sulphate . . . . . 48 | 9.56 | — 34 | 1.70 | — 7 | 9 | 6 | + 12 | — 25 |
| 10 b | » carbonate . . . . . 26 | 9.94 | — 32 | 1.15 | — 37 | 10 | 6 | + 25 | — 25 |
| 11 | Ammonium sulphocyanide . . . . 28 | 9.81 | — 33 | 3.50 | + 91 | 11 | 11 | + 37 | + 37 |
| 12 | Potassium » . . . . 36 | 15.73 | + 8 | 0.88 | — 52 | 12 | 8 | + 50 | 0 |
| 13 | Sodium » . . . . 30 | 7.92 | — 46 | 2.14 | + 17 | 6 | 5 | — 25 | — 37 |
| 14 | Flowers of sulphur . . . . . 12 | 12.97 | — 11 | 2.11 | + 15 | 4 | 3 | — 50 | — 62 |
| 15 | » » » . . . . . 100 | 13.61 | — 7 | 2.72 | + 49 | 16 | 23 | + 100 | + 187 |
| 16 | » » » . . . . . 500 | 12.39 | — 15 | 2.58 | + 41 | 11 | 14 | + 37 | + 75 |
| 17 | » » » . . . . . 1000 | 7.37 | — 49 | 3.17 | + 73 | 10 | 14 | + 25 | + 75 |
| 18 | » » » . . . . . 2000 | 13.97 | — 4 | 2.34 | + 28 | 9 | 11 | + 12 | + 37 |
| 19 | » » » . . . . . 3000 | 2.62 | — 82 | No seeds germinated | | A few seeds germinated but plants died | | | |
| 20 | » » » . . . . . 5000 | 0.63 | — 96 | » » » | | A very few » » » » » | | | |
| 21 | » » » . . . . . 7000 | Plants died | | » » » | | No » » | | | |
| 22 a | Nothing added but calcium carbonate . | 15.71 | | 2.48 | | 8 | 10 | | |
| 22 b | » » » » » . | 13.48 | | 1.19 | | 7 | 5 | | |

In a 4th series of experiments the same type of soil was used adding the same amount of calcium carbonate. Besides the different sulphates, the soil was mixed with the corresponding carbonates or oxides, in order to control and to better determine the effect of the sulphur. The amount of sulphur added in its various compounds, was equivalent to 12 lbs. per acre. In each box were planted 50 Early Jersey Wakefield cabbage seeds, which were afterwards thinned to 25 average size plants. When the plants in the best boxes had reached the transplanting stage, all were cut close to the ground. The plants were air-dried and weighed.

The soil was sifted and in each box 50 Giant Southern Curled mustard seeds were planted, which after germinating were thinned to 15 average size plants. After the best plants had commenced to bloom, all the plants were cut close to the ground, air-dried and weighed.

The same soil was employed a 3rd time for radishes. In each box were planted 20 Scarlet Globe radish seeds, which after germinating were thinned to 12 average size plants. The plants were gathered before they were fully matured and weighed. The results of this 3rd. series of experiments are added to Table V.

The results obtained with *cabbage* show that only two sulphates proved beneficial. A few had no effect, while several were harmful to the plant. With *mustard*, several of the sulphates gave good gains over the checks and all gave higher yields than their corresponding carbonates. In the case of *radishes*, the results were more irregular, but there is no doubt but that sulphur fertilization in some cases was beneficial.

Experiments were tried by the writer in growing *alfalfa* in sand cultures so as to determine the availability of the sulphur in its different compounds for the growth of this plant. Of the 38 substances used, the best results were obtained respectively with magnesium, ferric, sodium, potassium and ammonium sulphates. Good results were also obtained with sulphur. In nine out of fifteen cases the sulphates gave better yields than their carbonates. Only four, of the 38 substances used, were injurious to the growth of alfalfa and gave smaller yields than the checks.

Directly after the addition of sulphur to the soil, after a period of about four months, that is after the plants have been cut down, the writer has examined the percentage of sulphate sulphur in relation to the total percentage of sulphur, and has found that the sulphur is rapidly oxidized to sulphate, more so in fertile soil than in poor soil, and to a lesser extent with sand. When the soil contains a large amount of sulphur, it becomes acid in consequence of the oxidation of the sulphur, and if this acidity is not neutralized by a base (calcium carbonate), it will be injurious to the growth of the plants, as is shown in Table IV for the pots Nos. 19, 20 and 21.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS

151 - **A New Method Adopted in Russia for Studying the Root System of Cultivate Plants.** — KOVÀL, V. D., in *Semledieltcheskaja Gazeta* (Agricultural Gazette No. 35 (99) pp. 974-977; No. 36 (100) pp. 996-999. Petrograd, August and September, 1915.

The writer reviews the different methods adopted in studying the roo systems of cultivated plants (Orth, Dehérain, Heinrich, Müntz, Girard Romistrov, Sohovskji), shows the difficulties connected with each of them and draws attention to the fact that this study can only give effective re sults if it is prosecuted in the field and under the natural conditions of th plant's growth.

The new method of studying the root system of cultivated plant has been worked out in Russia by the " Agronomical Section of the Burea of Agricultural Machinery " attached to the Ministry of Agriculture. It i based on the principle of removing particles of soil by means of a current o air. Attention was first drawn to the possibility of applying this principle i the experiment field at Akimovka (Crimea). This is an experiment fiel belonging to the Bureau and frequently exposed to high winds; these some times reach the speed of 25 metres per second, and in unsheltered spot often remove the upper strata of the soil, thus laying bare the roots.

After a series of laboratory experiments to determine whether it wa possible to apply this principle, an apparatus called a " dust aspirator " wa constructed according to the directions of the Agronomical Section. Th choice of the name, however, was not a happy one, seeing that the appa ratus not only removes soil particles by means of a current of air, but ca also be used for other purposes, as for instance the analysis of the soil struc ture, the determination of the state of the division of the soil by the sepa ration of its particles by a current of air, etc. so that the apparatus migh be said to be one of universal application. It has in fact been used in variety of ways.

This apparatus is very simple; it consists of a motor of 4. H P. borrow ed from an automobile, and of a fan. The latter produces both pressur and suction draughts which can be directed towards any point. Th experiments have chiefly been carried out on maize roots; a certain numbe of these plants have been obtained and the natural arrangement of thei roots in the soil has been registered.

The method of obtaining the roots in their natural surroundings in th field is as follows :

It includes 3 operations : 1) eliminating the soil particles by the help o a pressure draught; 2) coordinating the positions occupied by the roots i the soil ; 3) collecting the roots and making a plan of their vertical arrange ment.

The 1st operation is effected thus : first there is placed around the plan to be studied an apparatus whereby the position of any point of th plant or its root system can be fixed in space. This apparatus, whic consists of a square horizontal frame with a movable cross-bar and fur nished with a level and a plumb-line, is supported on 4 legs very deepl sunk in the soil. The exact position of the plant relative to the fram is then fixed by measuring 3 coordinates. After taking these measures, th apparatus is removed, but the stand is left in the ground, and then begin

he removal of the soil particles by means of a current of air. First the pres-ure draught is directed upon the collar of the plant, whence the soil parti-les are gradually removed until the beginning of the root system is reached. his point attained the current of air is directed upon each root and the oil particles are removed till the root is completely exposed. The exposure f the roots is only effected easily and quickly when the ground has been pecially prepared for the purpose, under natural conditions it requires ome time and certain auxiliary operations. In order to facilitate the de-achment of the largest and most compact particles, a brush is most often sed. The best plan, however, is to add a sufficient amount of water to the oil (the results of experiments have shown that this is about $^2/_3$ of the quan-ity producing total imbibition) after which the particles are easily and quick-y removed. In order to facilitate the exposure of the root system, it is herefore important to make the soil damp up to a certain point, this can be one without difficulty. If owing to the working of the apparatus, the roots ave abandoned their natural position, they are fixed in the soil by means f a special kind of iron pin. Should the root break, the fragments must be oined together by means of a small tube of paper and the root must be fix-d in the soil. Each root bears a number. If the work cannot be finished n one day, as often happens in the case of plants with a much developed root ystem, the exposed roots are covered with moist soil, in order to prevent esiccation and all the resulting complications.

The 2nd operation consists in coordinating the positions occupied in he soil by the roots. It has been seen that after they have been laid bare, he roots are left and fixed in the position they actually occupied. The po-ition of the roots in the horizontal and vertical plane is determined by neans of the same apparatus which was used to fix the position of the ollar of the plant and the profile of the soil. For this purpose, the frame s attached to fixed feet, its horizontality is tested by means of a level and he position of each root is determined by measuring 3 coordinates. The neasurements are made every 5 cm., and in less exact experiments, every o cm., of its length, and are inscribed beneath the respective number of ach root. By means of these figures the arrangement of the root system f the plant can be transferred to a drawing, or the dried roots of the lant affixed to the paper in such a manner as to correspond with the nscribed figures. Further, to determine the arrangement in the horizontal lane, they can also be photographed from above. In order to determine he arrangement of the roots in the vertical plane it is necessary to draw, on he basis of the figures ascertained, the profile of the ground, the positions f the collar and roots of the plant, to inscribe the figures giving the distance f each point, and finally, to apply all the root system in such a way as to nake it correspond with the drawing.

Without wishing to attribute a universal importance to the method described above, the writer nevertheless considers, that in researches relating o the effects of working the soil, its capillarity etc., it may render real service and throw a light on a series of problems that have hitherto remained bscure.

152 **The Vitality of Seeds passed by Cattle.** — MILNE, D. (Economic Botanist, Punjab) in *The Agricultural Journal of India*, Vol. X, Part IV, pp. 353-369. Calcutta, October 1915.

These experiments were undertaken to determine whether whole wheat grains, fed to bullocks working in the wheat fields, would pass through the animals and retain their power of germination, thus becoming a source of impurity in pure culture plots.

Towards the end of January 1915, six bullocks were chosen, aged 8 to 14 years and penned so that the dung from the various animals should not mix. From the evening of January 21 until the evening of January 22 each bullock was given daily at 6 p. m. two seers (4 lbs.) of whole wheat grains previously soaked for one hour in cold water. At 10 p. m. the uneaten grains were removed, air dried and weighed. The fodder consisting of green oat plants and wheat straw was also weighed. The dung was collected in numbered baskets which were cleared every day at 7.30 a. m. and 6 p. m. Each day at 8 a. m. the dung was carefully washed and the grains picked out for germination on sterilised sand covered with sterilised flannel.

The results are summarised as follows :

| No. of bullock and age | Weight of unsoaked wheat grain eaten by bullock in lbs. | Number of unsoaked wheat grains per lb. | Number of wheat grains eaten by bullock | Total number of wheat grains which produced strong healthy plants after passing through animal | As Percentage of grains eaten |
|---|---|---|---|---|---|
| I. – 14 years . . . | 10.25 | 11 400 | 116 850 | 23 996 | 20.5 |
| II. – 13 » . . . | 26.5 | „ | 299 100 | 43 709 | 14.4 |
| III. – Over 14 years | 5.0 | „ | 57 000 | 5 572 | 9.6 |
| IV. – 11 years . . . | 20.0 | „ | 228 000 | 25 036 | 10.9 |
| V. – 8 » . . . | 27.25 | „ | 310 650 | 35 311 | 11.3 |
| VI. – 8 » . . . | 23.875 | „ | 272 175 | 41 872 | 15.4 |

Wheat grains capable of germination appeared in the dung within 13 ½ hours after the experiment began. Two or more days later the number of viable grains passed by a single bullock varied from 1000 to over 4000 in a working day while the number passed in 24 hours reached as high as 9000. Wheat grains continued to appear in the faeces for two days after wheat had been excluded from the diet.

It follows therefore that uncrushed wheat grains fed either intentionally or accidentally to cattle working on pure culture wheat plots are a danger to the purity of those crops.

Seeds of gram (*Dolichos biflorus*) were aso observed to pass through the animal undigested but none were found able to germinate.

Viable seeds of the following were also found in the dung :

*Asphodelus fistulosus*,
*Chenopodium album*,
*Lathyrus aphaca*.

53 – **A Case of Albinism Due to Cold and Occurring in the Leaves of Uruguay Oats.** — GASSNER (Rostock Botanical Institute), in *Berichte der Deutschen Botanischen Gesellschaft*, Vol. 33, No. 8, pp. 478-486. Berlin, 1915.

The writer subjected the seeds of various species of cereals to different ermination temperatures, in order to study the effect of the latter upon the evelopment of the plant. . Germination took place in the dark and the eedlings were therefore completely yellow on account of want of chlorophyll n their cells.

At the end of some days, the young plants were placed in pots and xposed to the light, when they soon assumed a bright green colour. Their evelopment was fairly normal.

One species, however, Uruguay oats, manifested on germination an anoaly that has hitherto been little known. The leaves and stalks were not ellow, as in the case of other species, but wholly, or entirely, white. The lants presenting this anomalous appearance had germinated at a lower temerature than the others, namely at 1-2° C. In the case of those plants of hich the organs were not completely blanched, the white patches often dispeared under the influence of sunlight. When however, the leaves and talks were entirely white the chlorophyll did not appear on the plants being xposed to the light. All such plants continued to produce white leaves hich, having no chlorophyll, finally died.

The writer has not yet determined the direct cause of this albinism, but seemed certain that the chief factor was the cold. It is very probable hat low temperatures (1-2° C.) can injure the chloroplasts of seedlings ithout harming their vegetative cells. When the germination temperature is ery low, the plant develops normally for the first period, but is incapable f making chlorophyll. As the latter substance is indispensable for assimilaion, the plant dies after a certain time.

The writer also tried to determine whether the albinism he had bserved is a hereditary character in Uruguay oats. For this purpose, he owed the seeds of plants having partially white leaves and stalks. He lways obtained normal seedlings without white patches on either leaves r stalks.

Mr. Gassner intends to continue these investigations.

54 – **The Question of the Toxicity of Distilled Water.** — HIBBARD, R. P. (Michigan Agricultural College) in *American Journal of Botany*, Vol II, No. 7, 389-401. Lancaster, Pa. October 1915.

In studying the effect on organisms of single salts or mixtures of salts n solution a control or check solution is necessary. Such solution should ause no distuibance of the regular functions of the plant.

For this purpose distilled water has been used but recently the advanages of a physiologically balanced solution have been realised. Both ave their drawbacks ; the latter because each organism demands a speciily balanced solution. The disadvantages of distilled water have been ttributed 1) to the leaching of salts from the roots ; 2) to starvation of he roots ; 3) disorganisation of certain complex compounds in the root issues; 4) to the occurrence of a toxic substance derived from the apparatus.

The writer investigated the toxicity of distilled water using lupin seedlings in distilled water and various mixtures of distilled and tap water.

He concludes that the harmfulness of distilled water is not due to any one predominant factor, lut rather to a resultant of many.

Firstly, there is the question of the adjustment of the tissues. Better growth was obtained when the change from tap to distilled water was gradual than when made suddenly.

Secondly, there is the question of root excretions. Roots grown continuously in distilled water presented the appearance of roots injured by dilute solutions of toxic salts. No toxin was isolated from the distilled water, but changing the water four times daily greatly increased the rate of growth of the roots.

155 - **Water as a Factor of Production in Leguminosae** (Royal Hungarian Agricultural Experiment Station at Magyaróváz). — HERKE, S., in *Kisérletügyi Közlemények* (Bulletin of the Hungarian Agricultural Stations). — Vol. XVIII, Part 4, pp. 766-787, 6 figs. Budapest, 1915.

According to the latest researches, the development of plants, their absorption of nutritive substances and the amount of the crop stand in mathematical relation to the variation in the factors of production. Since, however, each factor acts in a different way upon the development of the plant, there is also a difference in the relation between each factor of production and the amount of the harvest. There is a certain combination of these factors which gives the best results, but if, for example one of them causes a disturbance in this balance (undergoes a change in the course of growth), the relation between the variation of another factor and the amount of the harvest also undergoes a modification, all else being equal.

During the last 20 years, Seelhorst and his pupils in the first place, and more recently, Pfeiffer, Blanck and Mitscherlich have systematically studied the part played by water as a factor of plant production. Their experiments have confirmed the existence of a certain relation between the size of the crop and the increasing amount of the water supplied. According to the experiments of Mitscherlich, Pfeiffer and Blanck, the maximum crops of oats, peas and potatoes can be obtained with a volume of water respectively corresponding to 100, 70, 90 per cent of the water absorption capacity of the soil.

With a view to determining the influence exerted by water on the development and yield of leguminosae, and on the increase of nitrogen in the soil in which they are cultivated, the Royal Hungarian Station of Agricultural Experiments undertook some experiments in 1913 and entrusted their carrying out to the writer. The experiments were made in painted earthenware pots each containing in one series, 44 lbs of sandy, slighty calcareous soil, and in the other series, 39.6 lbs of clay containing much lime. The subjects of the experiments were : *Lupinus albus*, *Ornithopus sativus*, *Pisum arvense* and *Vicia faba*. In each pot were planted 48 seeds of *Lupinus albus*, *Pisum arvense* and *Vicia faba* and $5 \times 48$ seeds of *Ornithopus sativus* After the seeds had germinated, 36 stems of the first three plants and $3 \times 36$ stems of the fourth were left in each pot. The plants extracted were buried

in the soil of the respective pots. All the four kinds of plants were sown in the two sorts of soil on May 15 and harvested on August 13. From the time of germination, they were supplied with water in the following manner ; 6 pots of all the plants growing in each kind of soil received an amount of water corresponding to about 30 per cent of the absorption capacity of the soil, and 6 pots received an amount corresponding to about 90 per cent of the said capacity. In order to simplify matters, the writer called the first volume of water " not plentiful, " and the second " plentiful ".

From these experiments, of which the results are shown by photographs and summarised in numerous tables, the writer draws the following conclusions :

In the case of the Leguminosae, water plays an important part. " Plentiful water " increased the crop much more than " not plentiful ", the effect of water on the different plants is not the same, it also depends on the nature of the soil. On slightly calcareous, sandy soil, " plentiful water " considerably increased the yield in dry matter of all four plants, namely 36 per cent in the case of *Lupinus albus*, 26 per cent in that of *Ornithopus sativus*, 50 per cent in *Pisum arvense* and 25 per cent in *Vicia faba*. On very calcareous clay, " plentiful water ' decreased the yield of *Lupinus albus* 31 per cent, while it increased the crop of *Ornithopus sativus* 4 per cent and the crops of *Pisum arvense* and *Vicia faba* 136 per cent and 88 per cent respectively. In the presence of " plentiful water " the injurious effect of the lime upon *Lupinus albus* is much more noticeable than in the presence of " not plentiful water ". In comparison with " not plentiful water ", " plentiful water " has an almost equal effect upon the root yield, but less upon the green portions of the plant.

" Plentiful water " diminished the nitrogen percentage of the green parts in a more noticeable manner in the case of *Lupinus albus* and *Ornithopus sativus* than in that of *Pisum arvense*, or *Vicia faba*. On the other hand, it did not alter the nitrogen percentage of the roots. Water promoted the formation of nodules; with " abundant water ", especially in the cases of *Pisum arvense* and *Vicia faba*, many more nodules were formed upon the roots than with " not plentiful water ".

The water also had a material effect upon the reserve of nitrogen. With " plentiful water ", the nitrogen percentage of the two soils in the case of all four plants was higher than with " not plentiful water "

At the time of harvest, the total amount of nitrogen (soil nitrogen + plant nitrogen) was greater in the case of one of the pots receiving " plentiful water " than in that of one supplied with an amount not exceeding 30 per cent of the water that the soil was capable of absorbing. The greatest difference in nitrogen content was observed in *Pisum arvense* and *Vicia faba*.

156 – **Contributions to the Physiology of Stomata in *Saccharum officinarum* L. Observations on Transpiration in Sugarcane.** — KUYPER, J. in *Archief voor de suikerindustrie in Nederlandsch-Indie*. Year XXIII No. 44, pp. 1673-1700 and No. 45, pp. 1715-1733. Soerabaja, November 1915.

Pursuing his work on the structure of stomata (*Archief*, vol. 22, 1914, pag. 1679) the author now made investigations about the way in which

stomata are affected by light, temperature, and humidity. The results are published in the first pamphlet. In the introduction a short account is given of the new literature on the subject ; special attention is given to the new American investigators as Briggs, Shantz, Livingstone, Lloyd, Cannon, Shreve and the work of Prof. O. Renner.

Chapter I deals with the method and its application. After some vain trials with other methods, the author decided to use only the paraffine oil-kerosine oil-benzin test, first introduced by E. Stein. The opening of stomata is estimated by the rate of rapidity with which these several agents penetrate into the leaf tissue. Several hints are given about peculiarities found in its application.

The influence of light and temperature on the opening of stomata is the question dealt with in the following chapter. Direct sunshine shows itself a very active agent for opening the stomata ; darkness prevents from opening, and causes closure when the leaf was open before. It seems that prolonged darkness so operates, that the stomata open to a constant but very low degree. When there is a moderate quantity of light *e. g.* from a clouded sky, the stomata open slowly and generally not to such a degree as in strong sunshine ; this is one of the reasons why sunny mornings are a great profit for cane cultivation. In investigating the influence of darkness a big dark chamber was used, made from cloth and bamboo, which made it possible to work with 6-month old plants in the field.

However, the dark cloth absorbed such a quantity of warmth from the tropical sunbeams that the temperature rose to about 43°-45° C; the result of which was, that instead of closing of stomata by darkness, opening by heat resulted. When a shelter against the sun was made over the black room the temperature remained normal and then darkness caused closure of stomata as usual.

Only a few experiments were made on air humidity ; the stomata seem to be more opened by a high relative humidity than by a low one. In the field however a high humidity of the air is almost always connected with and is the result of a high soil humidity owing to rainfall or irrigation : in consequence the plant is saturated with water. The higher the rate of saturation the wider is the opening of stomata and the longer the stomata remain open under unfavourable conditions. So it is difficult to see what is the specific influence of a high content of water in the air.

In another chapter several varieties of cane are compared as to the diurnal behaviour of stomata. In every variety the rate of penetration post meridiem is smaller than that ante meridiem ; however, it was found that a difference consisted as to the hour at which closing began. Moreover, in one variety the difference between maximum and minimum opening is much greater than in another. One gets the impression that early closing is a profitable feature for the plant; that the water consumption of such a plant is more economical than in others. As to the question of daily periodicity the writer concludes that many facts may be explained by the influence of light, temperature and water-content, but still there are

some indications that after a prolonged period of darkness the stomata try to open themselves during the time from 8 to 10 in the morning, which fact might be considered to point in the direction of periodicity.

The second article gives an account of transpiration experiments in connection with the movement of stomata. To get an idea of the rate of transpiration during the period of rapid development of the cane, 6-9-months old stalks were used; they were cut in the early morning, placed in big bottles, in which the water was covered with some oil. The bottles were protected from abnormal temperatures by a cover of rough pottery.

The loss in weight (often to an amount of 700 grams one day) was used as a measure for transpiration.

The writer thinks it much better to use this method than the weighing of potted plants. When using potted plants one will get quite other results, when the quantity of available water changes accidentaly. By watering the plant abundantly the loss in weight increased to twice the amount it reached originally. Fresh stalks were used every day. In the stoma-investigations it has been mentioned already that differences existed between several varieties as to the moment when closing began : the same fact was observed in transpiration. Some varieties showed their maximum rate for transpiration in the early morning whilst the loss in weight gradually decreased; other ones had a maximum at 11 o' clock and still other ones showed very small differences during the whole day. So one may distinguish three groups which differ in the way they use the available water; their behaviour also differs as to the cane production and their consistency against drought. The daiiy loss in weight may be in one variety twice as great as in another.

No connection could be demonstrated between the number of stomata per unit of leaf area and transpiration.

The maximum of transpiration may be reached after the closing of stomata has began ; the rate of transpiration is to a certain extent independant of the behaviour of the stomata.

Darkness or weak light is followed by a decrease of the transpiration rate.

Details about the number of stomata and the loss in weight by transpiration are given in the original publication.

The most important result of these investigations is the different behaviour which several varieties show in the rate of transpiration ; it promises to give a new principle for the selection of canes for certain conditions of soil and climate.

157 - **The Influence of Temperature on Respiration in Fruit.** — ZEREVITINOV, F. V. and TCHERKACHINE, D. I,. (Laboratory of Commercial Food Stuffs of the Commercial Institute, Moscow) in *Cholodilnoie Dielo* (Cold Storage Industry), No. 6-7, pp. 272-282. Moscow, June-July, 1915.

In the living fruits after harvest complex enzymatic processes continue, the chief of which is that of respiration. This process concerns chiefly the sugars : fructose, glucose and saccharose. Oil occurs in such small quantities as to have a negligible influence on respiration and starch is usually ab-

sent from ripe fruits except in the case of bananas which contain as much as 14 per cent.

Respiration of plants occurs normally in the presence of oxygen, but in its absence or when present in less quantities than 2 per cent intramolecular respiration occurs resulting in the decomposition of sugars with formation of carbon dioxide and alcohol. Like all other vital processes, respiration is dependent upon external conditions, of which temperature is particularly important.

In 1914-15 the writers made experiments on the influence of temperature on respiration in the following fruits: apples ("Antonowka" and "Crimean Chafran"); pears ("Royal"); grapes; oranges (Caucasian) and Italian lemons, using a special apparatus for the purpose.

The results of these experiments are as follows:

*Apple.*

| Temperature | Loss of weight in gms of $CO_2$ per kilogram of fruit |
|---|---|
| 0.1°. . . . . | 0.0046 |
| 7.5°. . . . . | 0.0131 |
| 15.2°. . . . . | 0.0235 |

*Apple.*

| | |
|---|---|
| 0° . . . . . | 0.0037 |
| 4° . . . . . | 0.0070 |
| 7.5°. . . . . | 0.0112 |
| 15.4°. . . . . | 0.0176 |

*Pear.*

| | |
|---|---|
| — 0.4°. . . . . | 0.0019 |
| 5° . . . . . | 0.0071 |
| 8° . . . . . | 0.0104 |
| 15° . . . . . | 0.0151 |
| 19.4°. . . . . | 0.0200 |

*Grapes.*

| Temperature | Loss of weight in gms of $CO_2$ per kilogram of fruit |
|---|---|
| — 0.1°. . . . . | 0.0015 |
| 7.0°. . . . . | 0.0071 |
| 14.7°. . . . . | 0.0168 |
| 25.2°. . . . . | 0.0293 |

*Oranges* (Caucasian).

| | |
|---|---|
| — 0.2°. . . . . | 0.0025 |
| 7° . . . . . | 0.0095 |
| 13.5°. . . . . | 0.0164 |
| 18° . . . . . | 0.0220 |

*Italian lemons.*

| | |
|---|---|
| — 4° . . . . . | 0.0020 |
| 0.5°. . . . . | 0.0040 |
| 7° . . . . . | 0.0090 |
| 10° . . . . . | 0.0119 |
| 15° . . . . . | 0.0166 |

Thus showing that respiration increases with increase of temperature. As a general rule a rise of 1° C. increases the yield of carbon dioxide per kilogram of fruit per hour by 1 millig am; the minimum being 0.8 mg in the case of lemons and the maximum 1.2 mg in the case of the apple "Antonovka". Generally the output in carbon dioxide increases more rapidly than the increase of temperature.

The most important constituents of the fruit are consumed, *viz*: the organic acids and sugars. Thus by storing fruits at low temperatures the consumption of organic matter is very much reduced. At a temperature of 7° C. apples lose 3 times as much carbon dioxide as at 0° C.; grapes and pears 5 times as much; oranges 7 times and lemons 5 times. Whilst stored at 15° apples lose 5 times as much, pears 8, grapes 11, oranges 8 and lemons 8 times as much as when stored at 0°.

Assuming that all the carbon dioxide is derived by the oxidation of sugars the writers calculate this loss as follows: at 0°, from 0.07 to 0.19 per cent, at 7° from 0.34 to 0.64 per cent, at 15° from 0.71 to 1.16 per cent per month.

158 – **Some Effects of Ethylene on the Metabolism of Plants** (1). — HARVEY, E. M. (Hull Botanical Laboratory) in *the Botanical Gazette*, Vol. LX, No. 3, pp. 193-214, figs 1-2. Chicago, Ill. September 1915.

Etiolated sweet pea seedlings were exposed in an atmosphere containing ·0001 per cent by volume of ethylene. The effects of the treatment were investigated under the following heads: 1) chemical composition, 2) acidity, 3) osmotic pressure and permeability and 4) respiration.

The results were as follows:

1. The simple soluble substances increased at the expense of the higher soluble and insoluble forms.

2. The hot alcohol-ether soluble substances (sugars, amino acids, amides, polypeptides, lipoids, etc.) increased by 8-9 per cent, while the insoluble substances (proteins, starch, cellulose, ligno-celluloses, etc.) were correspondingly diminished. The water content of the ethylene treated and control tissues was the same.

*a.* The soluble lower sugars (by direct reduction) were about 11 per cent more and the soluble higher sugars (by reduction after hydrolysis) about 3 per cent less; the cellulose content was also diminished by about 3 per cent.

*b.* Amino acids and amides were increased and the polypeptides apparently decreased; the protein content was also about 3 per cent less.

*c.* Fats were much less abundant but the free fatty acid value was unchanged.

3. No change in acidity was observed.

4. The osmotic pressure as determined by both freezing point and plasmolytic methods was increased.

5. The $CO_2$ production and $O_2$ absorption were retarded, but the respiratory ratio remained practically the same.

159 – **On the Inheritance of Some Characters in Wheat.** II. — HOWARD, A. and HOWARD, G. L. C. (Imperial Economic Botanists) in *Memoirs of the Department of Agriculture in India, Botanical Series* Vol. VII, No. 8, pp. 273-285. Plates I-VIII. Calcutta, October 1915. PLANT BREEDING

In a previous paper (2) it was shown that $F_1$ generation hybrids between bearded and beardless ears of wheat were intermediate in type. The simplest explanation of these results appeared to be that two factors are present in the bearded parent, one capable of producing short awns or tips only, the other when added to this resulting in fully bearded plants.

On the presence and absence hypothesis the results of the various crosses would be represented as follows (B representing the long and T the short factor):

(1) See also *B.* Feb. 1914, No. 113, and *B.* Oct. 1915, No. 1089. (*Ed.*).
(2) See *B.* Feb. 1913, No. 118. (*Ed.*).

1. Fully bearded wheats — BBTT.
2. Plants with tips only — bbTT.
3. Absolutely beardless plants — bbtt.
4. The $F_1$ generation between 1 and 2 — BbTt.
5. The $F_2$ generation — BBTT + 4BbTt + 2BbTT + 2 BBTt + bbTT + 2bbTt + BBtt + 2 Bbtt + bbtt.

In order to test this theory and isolate if possible the two factors, the cross between a fully bearded wheat and an absolutely beardless one was continued to the 4th generation.

Out of 247 $F_2$ plants, 230 ripened enough seed for sowing. Of the 17 unripe plants 1 was fully bearded 2 half bearded and 14 were tipped.

The results of the $F_3$ generation of a cross between a fully bearded and beardless are summarised as follows :

| | Fully bearded BBTT | Minute Tips BbTt | Nearly bearded BbTT | Half bearded BBTt | Long tips BBtt | Minute tips Bbtt | Short tips bbTT | Minute tips bbTt | Beardless bbtt |
|---|---|---|---|---|---|---|---|---|---|
| Expectation | 15.5 | 61.6 | 30.8 | 30.8 | 15.4 | 30.8 | 15.4 | 30.8 | 15.4 |
| Actual | 16 | 54 | 40 | 33 | 15 | 22 | 13 | 24 | 13 |

Four of these types *viz.* fully bearded, BBTT, beardless, bbtt, long-tipped, BBtt, and short tipped, bbTT, bred true in the $F_4$ generation.

Crossing the two latter types gave an $F_1$ generation exactly resembling the $F_1$ between the original parents and having the constitution BbTt. The $F_2$ generation of this cross showed all stages between beardless and fully bearded. The theory is therefore confirmed.

The isolation of the two constituents of the fully bearded character may prove of some practical value in India where there is in certain localities a preference for awned wheats which suffer less from attacks of birds and hold their grain better. By the selection of suitable types with short or long tips it might be possible to meet the prejudices of the cultivators while avoiding the main disadvantages of long awns.

The inheritance of felted and smooth chaff characters was further investigated and results similar to the above were obtained showing that two factors are involved in the felted character. Cases of felting were also observed in which only one character was involved. This factor is of considerable importance in the damper regions of India as it increases the tendency to lodge and the spread of rust, etc.

160 – **The Relation Between the Sugar Content and the Chemical Characters of the Descendants of the Same Plant of Sugar Beet in the 1st Generation.** — ANDRLIK, K., and URBAN J., in *Zeitschrift für Zuckerindustrie in Boehmen*, Year 40, No. 3, pp. 107-113. Prague, December 1915.

In their latest experiments the writers proposed to determine :

*a*) The relation between the weight of the root and its sugar content, on the one hand, and the relation between the weight of the leaves and the sugar content of the root on the other ; *b*) the relation between the amount of sugar and of dry matter in the leaves and roots ; the relation between the sugar content and the amount of ash in the roots and leaves ; *d*) the relation between the sugar and albumen contents of the roots and leaves.

The results of the experiments may be summarised as follows :

1) The descendants having the same saccharine content may vary in the weight of their roots and leaves, but these difference do not exceed the normal limit of variation. As regards the average sugar content and the average weight of the roots, the law of correlation has but a limited value ; the importance of this law is greater in the case of the average amount of sugar in the roots and the weight of the leaves. As to the last relation, it may be said that the larger the saccharine content of the roots, the less the average weight of the leaves.

2) The descendants having the same saccharine content may have different amounts of dry matter present in their roots and leaves, but these variations are within the normal limits for dry matter. As a rule, the smaller the amount of sugar, the less dry matter there is in the root and leaf.

3) Plants with the same saccharine content can have different amounts of ash in their roots and leaves, but these differences are always within the normal limit of variation. Generally, a larger amount of ash in the roots and leaves also corresponds to a higher sugar content in the roots and *vice-versa*.

5) Plants with a determined sugar content may have different amounts of nitrogen in their roots and leaves, but these differences do not exceed the normal limits. The average sugar content of beetroots seems to be in direct relation to the average amount of nitrogen in the roots and leaves, when it is a question of a slight increase in the amounts.

161 – **Intermediate Characters in Various Hybrid Species of Iris.** — I. DYKES, W. R. Do Mendels' Laws hold Good for Crosses between Species), in *The Gardeners' Chronicle*, Vol. LVIII No. 1500, pp. 196-197. London, September 25, 1915. — II. MOTTET, S. (Les Iris intermédiaires) in *Revue Horticole*, Year 87, No. 30, pp. 582-583, Paris, November 16, 1915.

I. — The writer crossed various species of *Iris* to determine if Mendelian laws were valid between different species. The results with numerous pairs of characters showed no dominance but only a blending of characters.

*Iris boissieri*, bulbous, with the beard of the sepals in the form of long straggling golden hairs 0.117 to 0.234 inch in length, crossed with *I. tingitana* having no trace of hair gave a hybrid with hair distinctly visible to the naked eye but less than 0.0585 inch in length.

*I. tectorum* (which has a tuft in place of hair) crossed with *I. cengialtii* (a hairy type) gave a hybrid with a light violet coloured tuft bearing a short hair.

*I. xiphium* (with perianth tube) crossed with *I. tingitana* and *I. filifolia* (having perianth tubes 0.975 and 0.507 inch. respectively) gave hybrids with perianth tubes respectively 0.507 und 0.234 inch long.

*I. clarkei* with solid stems crossed with *I. chrysographes* with the internal cavity of the stem occupying about half the diameter, gave a hybrid intermediate with central hollow almost but not entirely closed with pith.

*I. pallida* with papery spathes which become entirely white and dry before protruding from the floral opening, crossed with *I. variegata* with green and herbaceous spathes gave a hybrid with spathes green in the lower portion and parchment-like in the upper portion.

The hybrid between *I. reticulata* and *I. bakeriana* is intermediate between the parents as regards leaf shape.

Also with regard to the colouring of the petals many hybrids are intermediate between the parents of various species, *e. g. I. pallida* × *I. variegata ; I. trojana* × *I. variegata I. boissieri* × *I. juncea ; I. fulva* × *I. foliosa ; I. forresti* × *I. sibirica.*

All these cases appear to show that the law of dominance in the Mendelian sense is not universal and is not always valid for crosses between species.

With the exception of *I. chrysographes* × *I. forrestii* and also possibly of *I. pallida* × *I. variegata* and of *I. fulva* × *I. foliosa* all the above hybrids were sterile both with respect to their own pollen and that of both parents. The two possible exceptions are cases in which the parents are somewhat related whilst the fertile hybrid has more definitely related parents.

II. — Crossing *I. pumila* an early flowering species (beginning to end of April) with *I. germanica* of which the earliest flowers appear about the middle of May, gives numerous varieties named *Iris interregna* flowering in the first half of May, thus enabling a continuous supply of Iris for 3 months (April to June).

These new Irises are intermediate between the two parent species not only in date of flowering but for height, leaves and dimensions of the flowers.

AGRICULTURAL SEEDS

162 – **Calcium Hypochlorite as a Seed Steriliser.** — WILSON, J. K. in *American Journal of Botany*, Vol. II, No. 8, pp. 420-427. Lancaster, Pa., October 1915.

For certain physiological experiments seeds and plantlets free from active bacteria and fungi are necessary. Most attempts to secure such seeds or plantlets in any considerable number have resulted in failure, usually because of the harmful effects of the germicide, its low efficiency or the complicated methods required for treatment of the seed.

The writer reviews the various treatments tried from time to time by various investigators and notes the following substances as being most frequently used : mercuric chloride, alcohol, formalin, hydrogen peroxide and combinations of these. None of these substances has been found to be as satisfactory as bleaching powder (calcium hypochlorite). The method of using this substance was as follows: 10 grams of commercial chloride of lime (titrating 28 per cent chlorine) is mixed with 140 cc. of water.

The mixture is then allowed to settle for 5 or 10 minutes and the supernatant liquid decanted off or filtered. The solution or filtrate, which contains about 2 percent of chlorine, is used as the disinfectant. The volume of solution employed should be about 5 times or more the volume of the seed. It is not necessary to remove the traces of disinfectant from the seed since it does not appear to interfere with the germination unless the period of treatment is exceedingly long.

Experiments with many species of seeds showed that the time required for sterilising the seed was in most cases several hours less than the exposure necessary to produce injury.

The time required to sterilise the various seeds varies considerably: hus alfalfa requires about 6 hours while wheat requires more than twice s long.

This method may also be used in the eradication of plant diseases onveyed by means of the seed.

63 – **Production and Commerce of Forage Plant Seeds in Canada.** — CLARK, G. H., in *Dominion of Canada, Department of Agriculture, Seed Branch, Report of the Seed Commissioner* 1914. Ottawa, 1915.

In the following Table I, the data of the clover and grass seed produced in Canada in 1910, are given according to the last Census.

TABLE I. — *Clover and grass seed produced in Canada.*

| Provinces | Clover seed — pounds | Grass seeds — pounds |
|---|---|---|
| Prince Edward Island | 41 678 | 588 243 |
| Nova Scotia | 1 352 | 36 339 |
| New Brunswick | 3 573 | 86 916 |
| Quebec | 127 420 | 1 977 802 |
| Ontario | 20 011 052 | 5 872 171 |
| Manitoba | 900 | 115 131 |
| Saskatchewan | 16 | 75 916 |
| Alberta | 2 678 | 17 798 |
| British Columbia | — | 1 780 |
| Total for Canada | 20 188 669 | 6 772 096 |

Canada's exports and imports of clover and grass seed during the last four years ending March 31, are shown in the following Table II, which is compiled from the reports of the Department of Customs.

TABLE II. — *Exports and Imports of forage plant seeds in Canada.*

| Years ending March 31 | Export | | | | | | Imports | |
|---|---|---|---|---|---|---|---|---|
| | Clover seed | | | Grass seed | | | Clover and grass seed | |
| | Bushels | Value $ | Value £ | Bushels | Value $ | Value £ | Value $ | Value £ |
| 1911 | 211 118 | 1 656 815 | 340 909 | 78 586 | 213 158 | 43 859 | 921 933 | 198 719 |
| 1912 | 93 976 | 938 633 | 193 134 | 111 246 | 205 917 | 42 163 | 715 604 | 154 651 |
| 1913 | 69 149 | 738 377 | 151 929 | 117 621 | 124 949 | 25 709 | 981 190 | 203 954 |
| 1914 | 118 601 | 1 094 330 | 226 405 | 110 873 | 106 708 | 21 958 | 1 051 881 | 211 436 |

In years of normal production there is sufficient red clover seed produced in Canada, mostly in southwestern Ontario, to meet domestic requirements, and considerable quantities are exported. Canada exports alsike seed extensively in a year of average production, Toronto being one of the largest markets of the world, as all the seed sold in Canada is practically produced in Ontario. Alfalfa seed is almost entirely imported from the western United States and from Europe. The seed of white or Dutch Clover (*Trifolium repens*) is imported from Europe to Eastern Canada and from the north-western United States to Western Canada. Most of the timothy seed sold in Canada is imported from the United States. The chief timothy seed producing area of the world is within a radius of 250 miles of Chicago.

While practically all the field root seed in commerce is imported, principally from England, France, Germany, Denmark, and United States, some kinds are now being grown to a limited extent in different parts of Canada. The sources of seed supply may be divided as follows: *a*) the Experimental Farms, which grow standard and new varieties of grain under careful supervision; *b*) farmers who are specializing in seed growing, have their crops inspected and produce excellent seed grain. (Crops grown by members of the Canadian Seed Growers' Association are inspected in the field and again when threshed and ready to sell); *c*) reputable seed merchants; *d*) dealers who procure ordinary commercial grain intended for milling or feeding and represent it as seed; *e*) irresponsible travelling seed vendors.

The inspection of the seed trade, carried out in conformity to the Seed Control Act, has been intensified. More inspectors have been employed and the territory covered more thoroughly than ever before.

The following Table III gives the results obtained in the spring of 1914.

Table III. — *Control of forage plant seeds in Canada.*

| Provinces | Places visited | Dealers visited | Violations of the Seed Control Act | Prosecutions |
|---|---|---|---|---|
| Prince Edward Island . . . | 65 | 136 | 7 | — |
| Nova Scotia . . . . . | 156 | 349 | 1 | — |
| New Brunswick . . . . . | 120 | 305 | 35 | 3 |
| Quebec . . . . . | 460 | 1 310 | 274 | 9 |
| Ontario . . . . . | 643 | 1 586 | 224 | 6 |
| Manitoba . . . . . | 135 | 402 | 58 | 2 |
| Saskatchewan . . . . . | 141 | 555 | 87 | 5 |
| Alberta . . . . . | 78 | 331 | 18 | 5 |
| British Columbia . . . . . | 63 | 199 | 2 | — |
| Total for Canada . . . | 1 861 | 5 173 | 708 | 30 |

164 - **Selection of Wheats for Spring Sowing.** — BIFFEN, R. H. (Professor of Agricultural Botany, Cambridge) in *The Journal of the Board of Agriculture*, Vol. XXII, No. 9, pp. 867-871. London, December 1915.

February is the usual month for the sowing of spring wheat in England, but if this operation is delayed later than the middle of this month some consideration must be given to the particular variety of wheat to be sown.

After this date the ordinary autumn wheats are decidedly risky; the crop may ripen late and be attacked by sparrows, or the plants may fail to produce ears and merely continue their vegetative growth.

During the past season two of the safest autumn wheats for sowing up to the end of February were "Squareheads Master" and "Little Joss". In fact both these varieties were sown on several occasions in March with satisfactory results.

Some of the rapidly maturing varieties may be sown as late as April or even May with success. Of these the following are recommended:

*April or April Bearded*; ears slender, lax and bearded, red or reddish-grey in colour; grain red, slightly better quality than most English wheats, may be sown in April and harvested soon after autumn wheats.

*Nursery wheat*; ears broad, dense and well set, with pale beardless chaff; grain red and of better quality than most English wheats; yields a better crop than the preceding but requires to be sown earlier.

*Red Marvel* (*Red Admiral*) or *Japhet*; imported from France, ears large, lax, beardless, dull white colour; grain red and of poor quality; straw liable to bend and become discoloured; early sowings yield equal to autumn wheats.

*Dreadnought* (Hâtif Inversable) of French origin; ear large, dense, grain of medium quality; straw, short, suitable for deep rich soil; should be sown not later than Febraury.

*Red Fife*, *Burgoyne's Fife* and *Marquis* are suitable in certain districts and yield grain of excellent quality. They may be sown any time between October and the end of April.

*Cultural observations.* Spring wheats must usually be sown a little thicker than autumn wheats; from 3 to 4 bushels per acre being usual.

A dressing of $^3/_4$ to 1 cwt of sulphate of ammonia and 2 to 3 cwts of superphosphate per acre should be applied at seed time to encourage growth and hasten maturity.

165 - **Wheat Growing Competitions in the Roman Campagna in 1914.** — *Ministero di Agricultura, Industria e Commercio, Relazione della Commissione giudicatrice*, pp. 159, 14 Plates. Rome, 1915.

The plan of work of the commission comprised: 1) visiting the farms during the period between the appearance of the ears and maturation, and determination of the variety of wheat grown; the nature of the land; the preceding crop; the manures and preparation of the soil; time and method of sowing; quantity of seed sown; appearance of the crop and damage caused by fungus diseases, etc.; 2) examination of the material from the point of view especially of the commercial characters of the grain (height of plants, vigour of haulm, presence of rust, state of maturity of the ears,

quantity of grains per ear, general appearance, uniformity and colour of grain); 3) botanical study (weight per bushel, purity of grain, germinating power, physical properties of grain) and chemical composition of the wheats exhibited.

The wheats were divided into 7 groups, viz: Rieti, Olona, Cologna (represented by 63 out of 123 samples), Fucense tenero (soft) (7), Romanello (7), Gentile rosso, Carosella, Zucchetto, Noé (21), Inversable (9), Varieties of *Triticum turgidum* (5), Spring wheats (11). "Rieti" and "Fucense tenero" were generally of normal specific gravity whilst their weight per 1 000 grains was a little inferior to that of the same varieties cultivated in other regions. Compared with Rieti, Romanello did not show any appreciable differences with regard to the variation in the weight of grain but reached a higher specific gravity. In the case of Gentile Rosso the weight per bushel was generally high and the weight per 1 000 grains still higher although it was somewhat lower on the whole than in the more northern regions.

The samples of Carosella wheat showed a higher weight per bushel and weight per 1 000 grains than Gentile rosso. There was room for improvement in the weight per 1 000 grains of some improved samples of Inversable, and of the decidedly poor varieties of *Tr. turgidum*. The spring wheats showed normal condition with regard to these two characters. The germinating power was generally high for all the wheats exhibited showing that conditions were favourable to the maturation of the grains. In a Table are given the average, maxima and minima of the weight per bushel and per 1 000 grains as well as of the physical characters of the varieties Rieti, Gentile rosso, Carosella and Inversable, in relation to the grain grown from the original seed and from seeds obtained by reproduction.

Comparing the results of the various varieties exhibited, the following conclusions are drawn:

1) The conditions in the Roman Campagna are favourable to the cultivation of all the varieties of soft winter wheat at present more or less distributed throughout this region. With regard to quality, Cologna and Romanello appear to be superior to Rieti and Fucense and Carosella to Gentile rosso.

2) The varieties *Triticum turgidum* were not very successful on account of their long vegetative period and slow maturity. The quality of the grains also leaves much to be desired.

3) With regard to Vilmorin's Inversable, judging from the quality of the grain exhibited the writers consider this variety more suitable for the more fertile and less exposed regions.

4) The results of the cultivation of spring wheats are very satisfactory from the point of view of quality of grain and they are always preferable to late sown autumn wheats.

5) A comparison of the quality of the grain obtained from the first and second generations of local seed and that of the grain from the original seed shows great promise from the selection work undertaken by the Ministry of Agriculture.

The results of the chemical analysis showed generally a fairly high nutritive value in the wheats exhibited.

Out of 100 samples examined 55 contained from 14 to 16 per cent of nitrogen, 31 from 12 to 14 per cent and only 4 contained less than 12 per cent whilst 10 reached 16 to 18 per cent. All the samples contained more gluten than the minimum of 25 per cent required for bread making.

The results of chemical analysis were as follows :

| | per cent | | per cent |
|---|---|---|---|
| Phosphoric acid ($P_2O_5$) . . | 0.70 — 1.19 ; 70 % | contained from | 0.85 to 1.05 |
| Fa t . . . . . | 1.50 — 2.64 : 67 » | » » | 1.90 to 2.20 |
| Cellulose. . . . . | 2.22 — 4.00 ; 72 » | » » | 2.50 to 3.50 |
| Ash. . . . . | 1.70 — 2.53 ; 68 » | » » | 1.90 to 2.20 |
| Pentosans . . . . . | 6.22 — 9.04 ; 64 » | » » | 7 to 8. |

Comparing the nitrogen content of the samples grown from the original seed with that of samples of the same variety from different generations it appears that the climate of the Roman Campagna tends to increase the nitrogen content of wheats from more northern latitutes. Thus of 26 samples of Rieti grown from original seed, 4 per cent had a nitrogen content less than 12 per cent ; 42 per cent contained from 12 to 14 per cent ; 46 per cent from 14 to 16 per cent ; 8 per cent more than 16 per cent ; whilst of other strains of this variety grown locally 23 per cent contained less than 12 per cent of nitrogen, 65 per cent from 12 to 14 per cent and 12 per cent from 14 to 16 per cent. Similar variation was found in the case of the variety " Gentile rosso ".

The report concludes with notes on : the climatic conditions of the Roman Campagna in their relation to the cultivation of wheat ; rotations practised and the improvements effected by adopting more modern systems which secure a more intensive cultvation by means of lucerne ; the clearing and drainage of uncultivited land ; the use of mineral manures.

FORAGE CROPS, MEADOWS AND PASTURES

966 - **Effect of Frequent Cutting on the Water Requirement of Alfalfa.** — Lyman J. Briggs and Schantz U. L., in *Bulletin of the U. S. Department of Agriculture*, N. 228, 5 pp. Washington, 1915.

The writers have carried out some experiments designed to determine whether alfalfa in the early stages of growth ollowing a cutting has a water requirement differing from the water requirement of the plant during the normal period of growth, and to what extent frequent cutting or grazing during the hottest part of the year modifies the seasonal water requirement.

Two standard sets of selected Grimm alfalfa, each consisting of six pots of plants, were employed in these experiments. The plants were treated in the usual way up to the time of the first cutting on July 26. Following this date, the growth on the pots of series *B* was cut back weekly, and the growth of the plants in series *A* was allowed to proceed without interruption until the time of the second cutting. Both sets were then allowed to grow uninterruptedly until the third and final cutting was made. The results were as follows :

| Period of growth | Total dry matter produced (6 pots) | | Total water absorbed (6 pots) | | Water requirement based on 1 kg. of dry matter produced | |
|---|---|---|---|---|---|---|
| | Series *A* | Series *B* | Series *A* | Series *B* | Series *A* | Series *B* |
| | Grams | Grams | Kilos | Kilos | Kilos | Kilos |
| May 24 to July 26 (1) . | 794.0 | 472.3 | 474.8 | 289.3 | 600 ± 17 | 615 + 6 |
| July 26 to Sept. 6 . | 769.0 | 159.4 | 655.5 | 153.3 | 853 ± 13 | 975 ± 23 |
| Sept. 6 to Nov. 4. . | 464.0 | 223.2 | 195.1 | 104.8 | 421 ± 10 | 479 ± 16 |
| Combined . . . | 2.027.4 | 854.9 | 1.325.4 | 547.4 | 656 ± 11 | 642 ± 6 |

(1) Series *B* was replanted June 3.

The water requirement of the two series during the first period was practically the same. The difference is less than the probable error.

During the second period the water requirement of series *B* gave an increase of 14 ± 4 per cent on the water requirement of series *A*. It thus appears that alfalfa is slightly less efficient in the use of water when subjected to weekly cuttings. During the third period, the series *B* shows also an increase of 14 ± 4 per cent in water requirement compared with series *A*, which may be the result of the weakening of the plants during the second period through the forced reduction in the leaf and stem area of the plant This would tend to prevent the normal development of the root system, which in turn would increase the water requirement during the 3rd period, since a relatively greater proportion of food material would be diverted to the roots.

The water requirement based on the total dry matter produced during the season (May 24 to November 4) is practically the same for the two series; the difference, 14 ± 13, being without significance. It is interesting to note that the final figure of series *A* is higher than that of series *B* notwithstanding the fact that the water requirement of each of the three crops is higher in series *B* than in the check series. The explanation of this apparent anomaly is to be found in the relative yields during the second (midsummer) period, during which time series *B* produced only 18 per cent of its total dry matter, while the check series (*A*) produced 38 per cent.

Series *A* produced practically the same amount of dry matter during the second period as during the first while series *B* produced only 30 per cent as much during the second period. Series *B* was also maintained during the midsummer period with an actual expenditure of only one third the water required by series *A*. This forced economy in the use of water through frequent cutting seems not to be without effect on subsequent production. Series *B* produced only 48 per cent as much dry matter during the third period as the check series, while during the first period, notwithstanding the shorter period of growth, series *B* produced 60 per cent as much dry matter as the check series *A*.

The results here recorded indicate that the total consumption of water can be controlled to a considerable extent by pasturage or frequent clipping. This affords a means of limiting the growth of the crop so that its demand for water will not exceed the available moisture supply. It is evident that the greatest production can be obtained by allowing the crop to grow when the water requirement is lowest, i. e., in spring or autumn and by keeping the leaf surface at a minimum during the summer through clipping or pasturage. This affords a simple and practical means of obtaining a return from alfalfa commensurate with the available moisture and at the same time reducing the danger of drought injury. The writers state that a practice similar to that suggested has been gradually developed in Australia, where a hay crop is grown in the early spring and the alfalfa is pastured during the remainder of the year.

On the other hand the results of the experiments described show that when the moisture supply is adequate for continuous crop production during the season, close pasturage or clipping would result in a marked reduction in the amount of alfalfa produced. Consequently where grazing is practised greater production can be secured by intermittent grazing, that is by employing several fields which are pastured in rotation.

167 - **Scotland's Upland Grazings.** — MACPHERSON, D. and SMITH, W. G., in *The Estate Magazine*, Vol. XV, N. 11, pp. 609-610. London, November 1915.

Upland grazings occupy in Scotland 48 per cent. of the total land of the Kingdom. These lands are mainly devoted to sheep farming with flocks of Blackface and Cheviot mountain breeds. Cattle grazing occupies the lower marginal areas. The grazings are classified as belonging to five distinct types, namely :

1) Peatlands. — (*Calluna, Eriophorum and Scirpus caespitosus*).
2) Nardus Grassland. — (*Nardus stricta*).
3) Heatherlands. — (*Calluna*).
4) Molinia Grassland. — (*Molinia coerula*).
5) Alluvial and Flush Grasslands.

The extent and distribution of the individual types are determined chiefly by topography and climate, but past history, and interference by animals or man are important *e. g.*, grazing, burning, draining, liming. The types are relatively constant throughout, but may occur in various combinations in association with differences in the factors. Thus in different localities the grazing areas present distinctive features. This involves different systems of management, *e. g.* dry south-eastern area and humid western area of Scotland. Alluvial and flush grasslands, heatherlands and peatlands are most valuable to the grazier. *Nardus* and *Molinia* are of secondary importance. The value of a grazing depends on a suitable representation of types and on their relative disposition.

Dealing with the improvement of these lands, it was shown that alluvial and flush grasslands can be made to replace heather and *Nardus* by suitable irrigation with water derived from springs or with surface-water bearing rain-wash. Invasion of acid water deteriorates the pasture, favours *Nardus*, and, where " pan " is formed, promotes retrogression to moorland.

These grasslands are suitable subjects for manurial treatments, *e. g.*, basic slag. Destruction of bracken increases the productive capacity of the pasture.

The grazing value of heatherlands is greatly increased by regular burning on a suitable rotation. Renewal of burnt areas results through: 1) growth from the shoot ; 2) Colonisation by seedlings. The former gives the most rapid recovery. Types of heatherland with slow and rapid rejuvenating powers require different burning rotations respectively. Draining increases the proportion of heather in peatlands, but reduces that of cotton-grass (*Eriophorum*) and deer-hair grass (*Scirpus caespitosus*), and favours invasion of *Nardus*. Little improvement is possible.

Where flushing is possible good pasture may be induced, otherwise in *Nardus* and *Molinia* areas grazing value is improved by burning on a short rotation.

168 - **Cultural Experiments Conducted in Denmark with Different Mixtures of the Seeds of Forage Plants.** — LINDHARD, E., in *Tidsskrift for planteavl*, Vol. 22, Part 4, pp. 554-709. Copenhagen, 1915.

The results obtained by the writer during his experiments that covered a long period (1900-1912) are of considerable interest, for they are in direct contrast to the theories at present obtaining as regards mixtures of seeds in the case of forage plants.

At the time of his experiments, the writer used as a comparative mixture one recommended by Nielsen which has long been commonly employed in Denmark, namely:

| | | | | | |
|---|---|---|---|---|---|
| Early red clover . . . . | lbs | 6.4 per acre | *Phleum pratense* . . . . | lbs | 1.8 per acre |
| *Trifolium hybridum* . . . | » | 1.8 » | *Festuca pratensis* . . . . | » | 1.1 » |
| *Trifolium repens*. . . . . | » | 0.3 » | *Lolium perenne* . . . . . | » | 1.8 » |
| *Agropyrum repeus* . . . . | » | 3.2 » | *Lolium italicum* . . . . . | » | 1.6 » |
| *Avena fatua* . . . . . | » | 3.2 » | | | |

Which makes in all about 20 lbs. per acre.

From its composition, this mixture is as suitable for grass as for hay, it gives an early cut, and an abundant new, summer growth, both in the 1st and 2nd years ; the yield is certainly not very great, but it is constant and equal from year to year, even in the event of the red clover producing little. The large number of species composing this mixture prevents an entire failure of growth as often happens when only the most productive types are used.

On increasing the *Agropyrum* percentage at the expense of *Avena fatua*, the hay crop decreases, if on the other hand, *Avena fatua* predominates, the yield is large It should, however, be noted that this latter graminea will not grow on calcareous soil and is not suitable either for grass or pasture.

By substituting *Lolium perenne* for *Agropyrum*, the amount of hay is increased in the 1st year, but the crop is smaller in the 2nd year. If *Agropyrum* is replaced by *Phleum*, an abundant hay crop is obtained the 1st year, but the new growth is scanty.

In the experiments carried out by the writer, *Festuca pratensis* did not give very good results, as far as the hay crop was concerned, and proved very exacting on the soil, which has to be damp, rich in humus, and liberally manured. *Trifolium hybridum* only gives a good crop when the summer is cold and wet, while *T. repens* grows abundantly in low, cold localities. In order, however, to insure a good and constant crop of hay, it is necessary, as is otherwise known, to mix the *Gramineae* with forage *Leguminosae*.

Amongst the latter, red clover is much prized; it can, in certain cases, be replaced with advantage by *Lotus corniculatus* and by lucerne, which insure a heavy yield the 2nd year. In places where the special conditions of the soil and climate require that red clover should be entirely excluded from the mixture, because of its doubtful success, it is advisable to replace it by *Lotus corniculatus*. Though the latter has a somewhat late spring growth, its after growth is on the other hand abundant, and it does better the 2nd year than red clover. As for lucerne, it yields little the 1st year and only grows strongly in the 2nd and 3rd years.

The following is a summary of the results obtained with 10 *Gramineae-Leguminosae* combinations, which in their entirety, correspond to the most various cultural conditions, and when used suitably according to the individual case, give a much larger yield than the ordinary Nielsen mixture:

1) Early red clover and *Avena fatua* for biennial stands: the oats grow strongly the 2nd year.

2) Early red clover and *Poa* for damp soils where clover does not grow well.

3) Early red clover and *Lolium italicum* for annual stands: growth precocious and new growth very stout.

4) Early red clover and *Lolium perenne*: hay crop same as with preceding mixture, but new growth less strong.

5) Late red clover and *Phleum pratense* in biennial stands give a considerable amount of hay, but the new growth is weak.

6) *Trifolium agrarium* and *Lolium perenne* in annual stands behave like the preceding mixture.

7) *Trifolium agrarium* and *Lolium italicum* give an early cutting and abundant new growth.

8) *Anthyllis* and *Bromus arvensis* give a plentiful last cut.

9) *Anthyllis* and *Lolium perenne*: their cut is neither too early, nor too late, their new growth is abundant.

169 - **Cultural Experiments in Germany with *Trifolium pratense* from 18 Different Localities.** — ROEMER. C., in *Illustrierte Landwirtschaftliche Zeitung*, Year 35, No. 88, p. 574. Berlin, November 3, 1915.

In 1914-1915, the writer experimented in order to determine the productive value of the different kinds of red clover on the market, as shown under natural conditions in Germany. For this purpose, he used clover derived from 18 different localities, including the best-known clover-producing districts of Germany and also foreign countries. Each sample consisted of a mixture of seed of different local varieties which had not

been improved by selection, but faithfully representing their native characteristics.

The writer sowed the seed from each locality on 4 separate plots of 13.4 sq. yd. There were thus in all 72 plots. The seeds were sown in the spring of 1914 without any cover crop and the first cut was made on the 30th July following; the second cut in 1914 was not controlled by the writer. In 1915, two cuts were made, one on June 14, the other on September 28. The yields from each cut are given in the following Table.

| Original locality of clover | Green crop in lbs per plot | | | | Hay crop in cwt per acre | Relative yield with max. crop placed at 100 |
|---|---|---|---|---|---|---|
| | 1914 cut July 30 | 1915 cut June 14 | 1915 cut September 28 | Total | | |
| 1) Silesia | 27.72 | 54.34 | 19.8 | 101.86 | 65.63 | 100 |
| 2) Holstein | 29.26 | 55.44 | 16.06 | 100.76 | 64.66 | 99 |
| 3) Thuringia | 34.98 | 47.52 | 16.28 | 97.78 | 63.39 | 97 |
| 4) Transylvania | 27.72 | 50.82 | 18.48 | 96,82 | 62.43 | 97 |
| 5) Brandenburg | 31.68 | 45.76 | 18,48 | 95.92 | 61.80 | 94 |
| 6) Bohemia | 31.02 | 45.76 | 16.28 | 93.06 | 58.61 | 89 |
| 7) Chile | 33.66 | 37.18 | 19.58 | 90.42 | 57.97 | 88 |
| 8) Russia | 24.68 | 47.30 | 16.06 | 88.04 | 56.70 | 86 |
| 9) Austria | 22.00 | 47.74 | 17,02 | 86.76 | 55.75 | 85 |
| 10) Baden (Randener) | 24.20 | 43.56 | 18.70 | 86.76 | 55.75 | 85 |
| 11) Lower-Rhine | 25.08 | 38.94 | 19.36 | 83.38 | 53.41 | 82 |
| 12) N. Germany | 20.24 | 47.96 | 14.74 | 82.94 | 53.41 | 81 |
| 13) N. France | 29.70 | 41.14 | 11.88 | 82.72 | 51.19 | 81 |
| 14) N. England | 29.70 | 41.14 | 11.88 | 83.72 | 53.19 | 81 |
| 15) Rumania | 25.96 | 40.48 | 14.52 | 80.96 | 51.92 | 79 |
| 16) S. France | 25.52 | 39.60 | 14.30 | 79.42 | 50.97 | 78 |
| 17) Palatinate | 25.08 | 39.60 | 14.52 | 79.20 | 50.97 | 77 |
| 18) Moravia | 20.46 | 41.58 | 14.96 | 77.00 | 49.38 | 75 |

The best sample of red clover produced a crop exceeding the worst by one third. There are thus very great differences between the crops of the clovers introduced from the above-mentioned localities. The writer's experiments were carried out in East Germany. It is therefore necessary to choose for this part of Germany clovers coming from East Germany itself or else from Central Germany, or from foreign countries situated to the East of East Germany. The writer concludes that in choosing clover seed more attention should be paid than heretofore to the locality of origin.

170 - **Native Pasture Grasses of the United States.** — GRIFFITHS, D. (Agriculturist), BIDWELL, G. I. (Chief of Cattle-Food and Grain Investigation Laboratory) and GOODRICH, C. E. (Assistant Chemist, Bureau of Chemistry) in *U. S. Department of Agriculture, Bulletin* 201 (Professional Paper), pp. 1-52, Plates I-IX. Washington, D. C., May 26, 1915.

This bulletin consists of a compilation of the results of investigations from various sources on the economic value of the numerous forage plants occurring in the United States.

An alphabetic arrangement has been adopted as being more serviceable than one conforming to botanical usage. Few botanical data are given, more importance being attached to chemical analyses in relation to age of the plant.

171 - **American Cotton in the Punjab.** — ROBERTS, W. (Professor of Agriculture, Lyallpur) in *The Agricultural Journal of India*, Vol. X, Part IV, pp. 343-348. Calcutta, October 1915. FIBRE CROPS

American cotton was first introduced into the Punjab in 1884 when Upland Georgian seed was tried. The crop grew well but survived only in the form of stray plants mixed with the native cottons.It was reintroduced in 1902, and in 1903 experiments were made with acclimatised seed at Lyallpur, but it was not until 1905 that the work was taken up systematically by the Department of Agriculture.

In 1911 the area under American cotton was less than 10 000 acres and in 1914 it was not less than 70 000 acres. It is now well established that the yield of American cotton is on the average better than that of the native varieties and the critical period in its adoption is now passed. The plant has established itself by a sort of natural selection, unsuitable types having been largely eliminated by pests. The Agricultural Department has also helped by obtaining the support and co-operation of local ginners and of exporters who have done much by issuing pure seed and securing good prices at the auctions. One of the great difficulties is the mixing with native cottons that occurs, often due to the faults of the ginners and spinners.

172 - ***Urena lobata* a Wild Malvacea of Madagascar** (1). *Bulletin de l'Office Colonial*, Year 8, Nos. 92-93, pp. 373-379. Melun, August-September 1915.

This shrub attains a height of from 5 ft. to 9 ft., or even more. It stem is straight and the alternate cylindrical branches bear stellate hairs and are sometimes almost tomentose. The leaves are alternate, suborbicular, more or less dentate or lobed, cordate, and truncated or cuneate a the base, and hairy.

As *Urena lobata* is very polymorphous as regards the form of its leaves, it has been described by writers under a considerable number of names and possesses more than 20 scientific synonyms.

This plant, which is met with in all the hot regions of the globe, has been known for a long time as producing textile fibres, Amongst its popular names the following may be mentioned: Bunochra, Cay Bazloung, Cousin rouge, Grand Cousin, Mahot Cousin, Paka, Sikilengi, Kirijy, Kisiza, Pam-

(1) See: *B.* December 1914, No. 1114.

piana, Puéhu, Hérisson rouge, Grand Mahot, Cousin, Pisipini, Gnaxima and Aroinina. The textile fibre is more resistant than jute and comparative experiments have shown that it can be very useful in the manufacture of sacks. It is also most probable that by the employment of suitable chemical methods, very white, fine, strong fibre could be obtained which would be well adapted for making textile fabrics and lace, as the thread takes dyes very well. Paper made from *Urena* is very resistant.

In Madagascar this plant is chiefly found on alluvial soil and along the river courses. Its cultivation entails practically no trouble, for it is raised from seed and is easily propagated by cuttings. The operation of extracting the fibre presents no difficulties. After being immersed in water for some days strands up to 6 ft. in length can easily and rapidly be drawn out. Retting usually gives a greyish thread of which portions are more or less glossy ; when prepared and combed, the thread is whiter and more silky ; its appearance is very similar to jute. Its use is at present limited to the manufacture of very resistant ropes and string, more rarely it is employed for making fishing-nets and coarse, but very durable, textile fabrics.

In order to encourage the exploitation of *Urena*, the Governor General of Madagascar and its Dependencies has issued an order granting concessions for the installation of a factory, the cultivation of *Urena lobata*, and the right of gathering it.

RUBBER, GUM AND RESIN PLANT

173 - **Experiments in Java on the Fickendey Method of Tapping *Hevea brasiliensis*.** — De Jong, A. W. K., in *Teysmannia*, Year XXVI, Parts 8 and 9, pp. 502-510. Batavia, 1915.

Dr. Fickendey's method, consists in removing the suberous layer beneath the incision by scraping a strip of bark about 3 cm. wide, care being taken not to cause the latex to exsude. According to its inventor, this method should increase the latex yield from 10 to 20 per cent.

The chief observations made by the writer were as follows :

In tapping every day, a somewhat larger yield was at first obtained by the Fickendey method, but after 6 months of experiment, the average yield of the trees treated in the ordinary way proved to be a little more plentiful.

In comparison with other methods, the Fickendey system has not given satisfactory results and has even had an injurious effect upon the trees.

174 - **Experiments on Extracting Rubber from Dead *Hevea* Leaves in Java.** — Vriens, J. G. C., in *Mededeelingen van den Adviseur der A. V. R. O. S.* No. 2, pp. 21-22. Medan, 1915.

The writer treated with benzol the dead leaves which were still on the *Hevea* trees before the normal leaf-fall and compared the results with those obtained by the treatment of young leaves that had just reached their maximum development. The results of these extractions were negative, as it was impossible to obtain an appreciable amount of rubber.

Taking into account the high price of the necessary chemicals, the writer comes to the conclusion that it does not pay to extract the latex of *Hevea* leaves for the purpose of making rubber.

175 – **Data Collected During a Visit to Besoeki (Java) for the Purpose of Studying Tobacco-Growing.** — De Vriers O., in *Mededeelingen van het Proefstation voor Vorstenlandsche tabak*, No. XVI, 24 pp. Semarang, 1915.

STIMULANT, AROMATIC, NARCOTIC, AND MEDICINAL CROPS

The writer describes the special conditions obtaining in Besoeki, where the green tobacco leaves are bought by tobacco makers from the native growers. This system makes it difficult to exert any influence upon the cultivation and harvesting methods. At Deli, and elsewhere in Java, (in Vorstenland), where tobacco-growing is practised under the direction of Europeans, it is much better developed and attains a high degree of perfection. In practice, the method of cultivation, the choice of the different kinds, (" Deli ", " Kedoe " and hybrids) the treatment of the leaves etc., vary systematically from one place to another according to the special conditions of the climate and soil.

Formerly, a type of tobacco (" Vorstendsche Kanari") was grown in Besoeki which burned badly and gave a grey ash. Since the cultivation of hybrids obtained by crossing the Deli and Kedoe tobaccos the product has considerably increased in value.

The seed of the hybrids is obtained by artificial pollinisation on a large scale ; the female parents, (originally coming from Besoeki), being fertilised, after the removal of their stamens, with pollen from plants of the Deli and Kedoe varieties. The Deli × Hatano hybrids do not produce such satisfactory results, from the point of view of combustion, as the Deli × Kedoe hybrids.

The average yield is 1200 lbs per *bahou* of 1.53 acres (755 lbs per acre).

The leaves are dried with great care, the temperature in the drying sheds being regulated by open wood fires.

Contrary to the practice elsewhere, tobacco in Besoeki is first subjected for for 1 to 3 months to slow fermentation during which the temperature never rises above 95° F. After this preliminary fermentation, the leaves undergo the main fermentation according to the system obtaining in Deli and Java.

As a large sum cannot be expended upon sorting the leaves of a tobacco of mediocre quality, this operation is carried out very roughly, while the tobaccos of finer quality which are more prized in the market are treated with greater care and sorted with much exactitude. In this way, a product is obtained in Besoeki which is only worth about 4 d per lb on an average, while the other types of tobacco (such as the hybrids) fetch as much as 1*s*. 2 *d*. per lb.

176 – **Chemical Composition of the Autumn Leaves of the Mulberry.** — Di Maio, Clelia (Laboratory of Agricultural Chemistry of the Royal High School of Agriculture, Milan), in *Le Stazioni Sperimentali Agrarie Italiane*), Vol XLVIII, Part 12, pp 899-910. Modena, 1915.

VARIOUS CROPS

With a view to obtaining some information on the feeding value of mulberry leaves in the autumn, analysis was made of the leaves of two varieties (" Trentin " and " Sterile ") collected at different periods. The plantation from which the leaves were taken was established in 1897. The average weight of the leaf of " Trentin " variety was 2.50 gms. and that of " Sterile "

1.62 gms. "Trentin" No. 6 and "Sterile" No. 6 were cut during the winter and were not stripped in the following spring.

The results are given in the following table as percentages of the fresh leaf.

| Constituents | "Trentin" No. 6. Leaves of second growth | "Sterile" No. 6. Leaves of second growth | "Trentin" No. 2. Leaves of second growth | "Sterile" No. 2. Leaves of second growth | "Trentin" No. 3. Leaves of first growth | "Sterile" No. 3. Leaves of first growth |
|---|---|---|---|---|---|---|
| Water | 70.40 | 74.54 | 69.60 | 74.10 | 70.56 | 71.54 |
| Protein (crude) | 6.28 | 5.43 | 6.20 | 5.00 | 6.77 | 6.25 |
| Protein (actual) | 5.04 | 4.65 | 5.10 | 4.10 | 5.70 | 5.03 |
| Fats (crude) | 1.69 | 1.94 | 1 50 | 1.89 | 1.80 | 1.48 |
| Non-nitrogenous extract | 15.08 | 11.23 | 16.40 | 12.46 | 12.92 | 13.31 |
| Pentosans | 2.81 | 2.60 | 2.86 | 2.52 | 2.86 | 2.69 |
| Cellulose | 2.60 | 2.68 | 2.50 | 2.60 | 3.11 | 2.92 |
| Ash | 3.95 | 4.18 | 3.50 | 3.95 | 4.84 | 4.50 |

In spring leaves (first growth) of various varieties MENOZZI found from 4.25 to 6.08 per cent (dry matter) of pentosans whilst the above figures expressed in terms of dry matter become 9.45 to 10.21 per cent or nearly double MENOZZI's figures. Direct experiments are required to determine the influence of these substances on the feeding value of the leaf. The researches of MENOZZI lead one to belive that the silk-worm only partially digests the pentosans and that this portion is proportional to the amount of cellulose present, or else that neither pentosans nor cellulose are digested.

The above results show that the period of cutting the leaves has no appreciable influence on the composition of the autumn leaves, which resemble spring leaves in nutritive value to the silk-worms.

FRUIT GROWING

177 - **Ringing Fruit Trees**. — HOWE, G. H. in *NewYork Agricultural Experiment Station, Bulletin*, No. 391 pp. 575-584. Geneva, N. Y. 1915.

With the object of testing the value of ringing (*i. e.* removal of a complete ring of bark) fruit trees with respect to their productivenses, experiments were carried out during 1910-1913 with apple, pear, plum and cherry trees.

The results showed that under certain conditions ringing may induce and possibly increase fruitfulness of apples, but it rarely has these favourable effects on other fruits. The removal of narrow strips of bark is less injurious to plant growth than taking out wide rings. The practice should never be followed with stone fruits and only on young and very vigorous apple trees. The operation had no effect on the size, colour or maturity of the apples and the roots were diminished in size and vigour.

178 - **Apple Orchards in the North West of the United States.** — See No. 224 below.

179 – **Buried Peach Orchards.** — CLARK, FLORENCE L. in *The Country Gentleman*, Vol. LXXX No. 43, p. 1607, 2 figs. Philadelphia, October 23, 1915.

A mountain range, from 10 000 to 14 000 feet high, divides the State of Colorado into two parts differing considerably from each other in climatic conditions. While the western half is admirably suitable to fruit growing, the eastern slope is subject to spring frosts which render the growing of certain kinds of fruit, especially peaches, very risky.

Some years ago, W. B. Felton began experimenting with burying peach trees in winter, and now his system is followed with great success in the whole of eastern Colorado, some orchardists apply it to thousands of peach trees, but it is specially for the home orchard where peaches are not usually grown on account of the cold climate.

In planting an orchard with the intention of protecting it during the winter the Colorado growers set out yearling trees in the spring The roots on two opposite sides are cut off and the trees are set in the row with the remaining roots at right angles to the direction in which it is proposed to lay the orchard down. This direction is determined by the winds.

The following autumn and every autumn afterwards the trees are put down. When the leaves have dropped and the trees have ripened for winter, a trench is dug to each tree and water is turned into it and allowed to run until the ground is thoroughly soaked. The trees are worked backwards and forwards in order to permit the water to reach the roots and loosen them. The trees, even the largest and oldest, provided they have been laid down every year, can easily be pushed over with little injury to the roots. It is difficult to undermine old trees that have never been buried.

A plank is put on top of the tree as soon as it is pushed over to hold it down until the straw and earth can be placed. Roots, trunks, and branches are entirely covered. Just straw enough is used to prevent the earth falling through. As for earth, one inch of it, provided no holes are left, has been found sufficient to protect the buds through a temperature of 30° below zero.

In the spring the uncovering is done gradually, care being necessary for the best result. About the middle of April the growers begin to remove the earth without disturbing the straw. Ten days afterwards if the weather is good, the straw is loosened to give the blossoms air. Then about the first of May the straw is given a second shaking. When all danger from frost is over, about the middle of May the trees are quite uncovered and raised, they are then masses of pink blooms, with sometimes tiny green peaches among the blossoms.

In lifting the trees the ground is again saturated with water. The trees will not stand well alone and require short props.

This annual uprooting does not seem to be at all harmful to the trees. They live as long and are said to yield as much fruit, in proportion to the size of their tops, as those grown under more favourable climates.

180 – **Production of Peaches in the United States.** — See No. 237 below.

181 – **The Chemical Composition of the Fruits of *Anona Cherimolia* Mill.** — CUTOLO, ALESSANDRO (Municipal Laboratory of Naples), in *Le Stazioni sperimentali agrarie italiane*, Vol XLV, Part 12, pp. 889-898. Modena, 1915.

After reference to previous research upon the fruits of *Anona* (of which there are no complete analyses), the writer describes the methods of analysis he himself employed in his study of the fruits of *Anona Cherimolia* (gathered at Reggio Calabria); he obtained the following results:

Average weight of fruit 130 gms., maximum 292 gms; minimum 77 gms.

*Percentage Composition of Fruit.*

| | |
|---|---|
| Pulp | 64.20 |
| Rind | 20.20 |
| Seeds | 14.10 |
| Peduncle | 1.50 |

*Percentage Chemical Composition of Fruit.*

| | Fresh fruit | | | In dry matter | | |
|---|---|---|---|---|---|---|
| | Pulp | Rind | Seeds | Pulp | Rind | Seeds |
| Water | 73.47 | 67.46 | 9.78 | — | — | — |
| Fixed acid in citric acid | 0.823 | 0.546 | — | 3.10 | 1.67 | — |
| Volatile acid in acetic acid | 0.035 | — | — | 0.132 | — | — |
| Reducing sugars | 10.10 | 3.96 | 0.45 | 37.69 | 12.17 | 0.498 |
| Saccharose | 1.76 | 1.04 | — | 6.63 | 3.19 | — |
| Albuminoids (N. × 6.25) | 2.80 | 2.97 | 1.72 | 10.55 | 9,127 | 1.90 |
| Pectine | 0.12 | — | — | 0.452 | — | — |
| Cellulose | 4.08 | 15.72 | 26.05 | 15.38 | 48.309 | 28.82 |
| Fatty matters (soluble in ether) | 0.349 | 0.350 | 6.99 | 1.32 | 1.07 | 7.74 |
| Ash | 1.85 | 1.71 | 1.58 | 6.97 | 5.26 | 1.75 |
| Undetermined and lost substances | 4.613 | 6.244 | — | 17.776 | 19.20 | — |
| Aqueous extract | 13.66 | 4.92 | — | 51.48 | 15.21 | — |

Alkalinity of ash (expressed in $K_2CO_3$)

| | |
|---|---|
| Pulp | 32.1 |
| Rind | 54.5 |
| Seeds | 54.5 |

Characters of fats

| | |
|---|---|
| Refractive index at 25° C. | 68. |
| Index of saponification | 184.7 |
| Index of acids | 56 |
| Index of ethers | 128 |
| Meissl number | 1.6 |

The appendix contains a bibliography of 16 works.

182 - **Variation in the Flowers of the Papaya.** — KULKARNI, L. B. in *The Poona Agricultural College Magazine*, Vol. VII, No. 2, pp. 102-112, Plates I-IV. Poona, October 1915.

The papaya plant is extremely variable in its sexual characteristics, all stages between the monœcious and dicœcious forms being met with. Observations of individual trees have shown that these stages succeed each other on the same tree at different stages of its growth.

The successive stages in development of a male plant may be summarised as follows :

| | |
|---|---|
| 1st stage | Male flowers only. |
| 2nd » | Male + hermaphrodite flowers. |
| 3rd » | Hermaphrodite flowers only. |
| 4th » | Hermaphrodite + female flowers only, |
| 5th » | Female flowers only. |

The first formed hermaphrodite flowers are apocarpous as distinct from the later ones and the female flowers which are syncarpous.

These changes do not appear to be in any way connected with the removal or retention of the terminal bud, but merely with the increasing age of the tree.

183 - **The Classification of Mango Varieties.** — BURNS, W. (Economic Botanist, Bombay) and PRAYAG, S. H. (Bombay Agricultural Department) in *The Agricultural Journal of India*, Vol. X, Part IV, pp. 374-379, 1 Plate. Calcutta, October 1915.

The writers suggest an artificial system of classification for the numerous varieties of Mango occurring in India, based on the following characters of the fruits :

Right and left shoulders,
Basal cavity (attachment of stalk),
Beak,
Apex,
Sinus on left side,
Three dimensions,
Weight,
Colour,
Surface, nature and distribution of the small spots on the skin, thickness of skin.
Flesh, taste, colour and stringiness,
Stone, size, weight, fibre and markings.

Hybridisation experiments have been begun from which it is hoped to obtain some information as to the origin and inter-relationships of the different varieties.

184 - **The Diagnostic Value of Grape Pips.** — (Work of the Royal Hungarian Ampelogical Institute). — ANDRASOVSKY, J., in *Borászati Lapok*, Year 47, Nos. 37 and 39, (Supplement), Budapest, 1915. VINE GROWING.

The pips of the varieties of grapes cultivated in Europe generally differ from those of the American varieties in their long, thin beaks and also in the position of the hilum which in the European varieties is situated on

the extreme portion of the lower surface and usually not in the middle, but at a third of its length. There are also more or less marked differences between the pips of the different varieties of European grapes and the question has been raised as to whether these differences could be used in diagnosis.

As early as 1872, MILLARDET (1) remarked the importance of the pips in distinguishing between the species of wild vine. Engelmann (2) was also one of the first to recognise their importance; on the basis of the diversity of the pips, he tried to elucidate the characteristics of variety and species in the case of the wild vines of the United States, and to establish a proper classification. In the same manner FOËX and VIALA in 1885, and R. GOETHE (3) in 1887 attached great importance to the differences observed in the pips of American grapes. POTEBNJA (4) wrote in 1911 a paper on the diagnostic value of grape pips. From his observations on 28 rines from the Crimea, he established 10 types according to: the weight vf the pips; their length and width, the proportion between their length ond width, the shape and position of the hilum, the development of the aaphe etc.

Although his researches are very valuable, his theory cannot be used in practice. In 1912, A. BONNET (5) published his important observations, and described in several tables, the pips of the different vines and American hybrids which he had examined.

In 1912 and 1913, the writer examined from a diagnostic point of view a large number of vines cultivated in Hungary, and he was able to confirm the statement that there are a fairly large number of vines which, in certain cases, can be distinguished by their characteristics pips. According to the writer's observations, the following characters are of importance from the diagnostic standpoint.

1) *For the identification of groups*: the general form of the pip (body and beak); its weight, length and breadth (expressed in mm.); the proportion between length and breadth.

2) *For the identification of varieties*: the colour of the pip; the shape and exact position of the hilum etc.

The writer tabulates the weight of the pips he examined. The figures obtained agree in a general manner with those given by GOETHE. Taking these data as a basis, it is possible to distinguish: *light* pips 100 of which weigh less than 2.5 gms.; pips of *medium weight* of which 100 weigh from 2.6 gr. to 3.5 gms.; *heavy* pips of which 100 weigh over 3.5 gms.

The length of the pips varies between 5 and 8 mm, and their breadth between 3 and 5 mm.

(1) Millardet, Etude sur quelques espèces sauvages de l'Amérique du Nord.

(2) Engelmann, Les vraies vignes des Etats-Unis, 1876.

(3) R. Goethe, Handbuch der Ampelographie 2nd Edit. Berlin, 1887.

(4) Potebnja, Die Samen von *Vitis vinifera* und ihre Bedeutung für die Klassification der Sorten, in *Bulletin für angewandte Chemie*, 1911.

(5) A. Bonnet, Etude sur la graine, 1912. (*Ed.*).

On examining the ratio between breadth and length, the writer found that it varies between 1 : 1.5 and 1 : 2.3. To these limits correspond respectively the pips of the Léanyka vine which measure 4×6 mm. and those of the Italian Riesling which measure 3×7 mm.

The colour of the pips is variable. In general, in the varieties with black grapes, the pips contain more colouring matter than in those with white grapes. The pips of the first are often of a bright copper hue and even show a purple colour, those of the second are light brown, occasionally grey, but sometimes reddish brown (Ezerjó variety), in this variety, however, the mature vine is also reddish brown on account of its property of producing a larger amount of colouring matters.

As has been said above, in the pips of the European varieties the hilum is situated on the extremity of the lower side. Its developments is variable; in some varieties, the hilum is scarcely visible, in others, on the contrary, it is more marked and perhaps surrounded by a groove, or the groove may even be continued as far as the upper portion of the pip, bifurcating at the position of the raphe.

On the basis of these characters, the writer has tried to arrange the different varieties according to their pips in the following manner:

*Group I. — Body of pip somewhat round.*

*A*) Small light pips; length 5. to 5.5 mm., more rarely 6 mm, (in group *b* it is 7 mm. on account of the long beak); breadth 3 to 3.5 mm.; weight of 100 pips; from 1.8 to 2.5 gms.

*Varieties* classified under this group:

*a*) short beak "Juhfarku", "Mezesfher", "Valteliner rouge".

*b*) short beak "Muscat d'Alexandrie".

*B*) Pips of medium size and weight; length about 6 m.; breadth 4 m.; weight of 100 pips; from 2.5 to 3.5 gms.

*Varieties* "Blanc de Bourgogne", "Petit Blanc"; "Rose de Bereg", "Rouge de Tramini".

*C*) Large, heavy pips; length 7 to 7.5. mm.; breadth 4 to 5 mm.; weight of 100 pips; 3.5 to 4.5 gms.

*Varieties* "Elbling", "Aramon", "Chasselas":

*Group II. — Body of pip oval.*

*A*) Small light pips; length 5 to 6 mm.; breadth 3 mm.; weight of 100 pips 1.8 to 2.5 gms.

*Varieties* "Bakator", "Kovidinka", "Erdei", Szerémi gold (Green of Szerém).

*B*) Light pips of medium size; length 6.5 to 7 mm.; breadth 3 to 3.2 mm.; weight of 100 pips; 2. to 2.5 gms. The proportion between breadth and length is 1.12 and even more.

*Varieties* "Italian Riesling", "Oporto".

*C*) Pips of medium size and weight (with relatively short beak); length 6 to 6.5 mm.; width 3 to 3.5 mm.; weight of 100 pips; 2.5 to 3 gms.

*Varieties* "Leányka", "Rhenish Riesling", "Cabernet".

*D*) Pips of medium size and weight, with extremely short beaks; length 6 mm.; breadth 4. mm.; weight of 100 pips; 3 to 3.5 gms.

*Variety* "Kéknyelü".

*E*) Pips of medium size and weight with longer beaks; length 7 mm.; breadth 4 mm.; weight of 100 pips; 2.6 to 3.5 gms.

*Varieties* "Kékfrankos", Királyszölö, "Mustofehér", "Green Valteliner", "Ezerjó", "Hárslevelü", "Járdovány", "Kadarka".

*F*) Pips of medium size (thin) and medium weight; length 7 mm.; breadth 3 to 3.5 mm.

*Varieties* "Csomorika" "Szlankamenka", "Lisztesfehér", "Sylvani".

*G*) Large, heavy pips; length 7 to 8 mm.; breath 4 to 5 mm.; weight of 100 pips; 3.6 to 4.5 gms.

*Varieties*: "Furmint", "Szentolörincz", "Génuai zamatos" (Aromatic Genoa).

Seeing the utility of information regarding the pips, the writer hopes that wider and more exact data will be obtained by further researches.

185 – **Hybrid Self-Bearer Vines in France in 1915** (1). — PÉE LABY, E. in *La Vie Agricole et Rurale*, Year V, No. 20, pp. 357-362, Paris, November 13, 1915.

A summary of observations made near Toulouse. Hybrid self-bearers vary considerably in their resistance to mildew. Thus, during the serious attacks of disease in 1915, Seibel Nos. 2, 1020, 1077, 1082 and 138 remained almost free from disease after two treatments, whilst Siebel 128 failed owing to anthracnose to which in normal years and on the same soil it was immune.

Good direct self-bearer hybrids are as follows:

*Black hybrids*: Seibel No. 873: Seibel No. 4121; Seibel No. 1082: Malègne No. 829-6; Malègne, 2094-3; Malègne 2183-3; Baco No. 1; Jurie 580; Gaillard 194; Couderc or Coutassot 7120; Couderc No. 106-46.

*White hybrids*: Seibel No. 793; Seibel No. 880; Seibel No. 2653; Seibel No. 4645; Seibel No. 4991; Malègne No. 57-1; Malègne No. 1157-15; Malègne No. 1647-8; Malègne No. 1897-12; Couderc No. 235-120; Couderc No. 272-60; Girard No. 157.

*Rose hybrids*; Seibel 2857; Seibel No. 4464; Malègne No. 474-5

The writer has observed additional cases of self-bearer hybrids being more resistant to disease than the same hybrids grafted on various stocks. Cases in point are: Seibel No. 128, Seibel No. 1077, Gaillard-Girard No. 157, etc.

FORESTRY

186 – **Manurial Experiments in a Woodland Nursery in Austria.** — RUSNOV, P., in *Centralblatt für das gesamte Forstwesen*, Year 41, Nos. 5-6, pp. 171-179. Vienna 1915.

In 1914, the writer experimented in a woodland nursery with a view to determining the effect of phosphoric acid upon young plants

(1) See also *B.* Dec. 1915, No. 1301. (*Ed.*)

of spruce and pine. He used as phosphatic fertilisers, degelatinised bone meal and basic slag. The results showed that these two fertilisers have little effect upon young spruces and pines and that when applied in different amounts (90 — 180 — 360 — 720 lbs. $P_2O_5$ per acre) the results are much the same. From this the writer concludes that conifers are unable to assimilate very quickly the slightly soluble phosphates in the acids of the soil, because these fertilising substances are not as necessary to conifers as to agricultural plants.

In continuation of this experiment, LORENZ also made an experiment in a woodland nursery for the purpose of comparing the effects produced upon young spruce firs by the use of degelatinised bone meal and superphosphate.

The experiment field was divided into 3 lots. The first year one lot received superphosphate at the rate of 535 lbs. per acre, the second lot received 446 lbs. per acre of degelatinised bone meal, while the third was not manured and served as a control. The plots were then sown with *Picea* seed.

The second year the same treatment was repeated and the young plants were thinned some days afterwards. They were subsequently measured at different periods of growth.

The experiments showed that during the first year of growth, the superphosphate had a better effect on the young spruces than the degelatinised bone meal.

During the second year, there was less difference in the effect of the two fertilisers in the case of damp soils. Where the rainfall had been abundant during the growing period, the superphosphate had less effect than the bone meal. The reverse, however, occurred in dry soils.

## LIVE STOCK AND BREEDING.

87 - **The Chalcid *Hunterellus Hookeri* Parasitic on the Tick *Rhipicephalus sanguineus* in Rio Janeiro, Brazil.** — DA COSTA LIMA, A. (Entomologist to the Applied Branch of the Ministry of Agriculture) in *Ministerio de Agricultura, Industria e Commercio Revista de Veterinaria y Zootechnia*, Year V, No. 4, pp. 201-203, 1 Plate. Rio de Janeiro, August 1915. HYGIENE

The writer collected adult individuals and pupae of the tick *Rhipicephalus sanguineus* from a dog. The adults furnished no parasites, while on the other hand, as many as 11 specimens of *Hunterellus Hookeri* Howard were obtained from one pupa. The presence of this hyperparasite had already been recorded in Mexico. In addition to attaking the pupae of *R. sanguineus* it is parasitic on those of *Dermatocentor parumpertus marginatus*.

88 - **Contribution on the Use of Sugar as a Dressing in Veterinary Surgery.** — BUSSANO, GERARDO (Laboratory of Clinical Surgery of the Royal Veterinary High School, Milan) in *La Clinica veterinaria*, Year XXXVIII, No. 19, pp. 766-785; No. 20, pp. 810-816; No. 21 pp. 829-844, Plates 6. Milan, October 15, 30 and November, 15, 1915.

The writer gives a summary of the present knowledge of the use of sugar in surgery and its physiological properties (absorbant, antiacid, healing, antiseptic) and a description of his own observations and experiments.

In these experiments sugar or glucose was used alone without admixture of antiseptic, and applied to sutured or other wounds, especially in al operations on the feet. Experiments were also made with injections o solution of glucose in the abdominal cavity, under the skin, in the joints the trachea and jugular vein. Horses and mules were used for the purpose.

The general conclusions are as follows:

*A*) Solutions of glucose 5 to 10 per cent injected under the skin, in the abdominal cavity and joints of the animals under experiment are absorbed in a short time and without any disturbance other than a slight rise o temperature.

More concentrated solutions (25 per cent) at a temperature of 29° to 30° may be injected in the horse in the trachea and jugular vein with the double advantage of being more rapidly absorbed and easily tolerated. From 500 to 1000 cc. may be injected daily without leading to any disturbance in the functions of the larger organs and by repeating the injections for several days in succession a considerable improvement in the general condition of the animal is obtained. On this account solutions of sugar may be used advantageously in place of physiological solution.

The solution may be made either with distilled water or with physiological solution by dissolving 250 grams of sugar in 1000 cc. of solution.

*B*) Powdered sugar applied to any wound acts as an absorbant and antiseptic, and at the same time stimulates the nutrition of the tissues with formation of a granular layer over the wound leading to more rapid healing.

*C*) Sugar applied directly on sutured wounds protects them from all possible infection because it initiates rapid healing.

*D*) In foot operations generally accompanied by more or less considerable loss of matter, and especially in the partial or total separation of the hoof, dressings of sugar by rapidly cleansing the wound promote a rapid growth of horny tissue invariably visible in 12 to 15 days after the operation.

*E*) Since the sugar has the advantage of being a powerful deodoriser it eliminates the disagreeable odour from the instruments soiled with blood and discharges from the wound. This is particularly advantageous in operations producing a nauseous odour such as that of cancer of the frog of the foot. The use of sugar gives rise to a smell not unlike that of the alcoholic fermentation of musty grapes.

*F*) With dressings of sugar the formation of pus seldom occurs even with solutions moderately dilute and applied to a discharging or suppurating wound. After contact with the sugar the discharge from the wound diminishes and ceases with successive applications. When properly applied the dressings may remain in position from 8 to 10 or even 12 days without inconvenience.

*G*) Sugar may be used either solid or in solution without any special preparation. It is therefore very useful and practical not only on account of its low price but because of its always being readily accessible in urgent cases wherever they may occur.

*H*) Although therapeutic properties are common to both ordinary

ugar and to glucose the writer recommends the latter in preference on ccount of its lower price and more suitable physical character, being in he form of a very fine powder it adheres more readily, forming a very esistant and compact layer.

*I*) By its absorbant, antiseptic and healing properties sugar constiutes a dressing of the first order which may render great service in veteinary surgery, especially in private practice, in place of ordinary antiseptic owders.

89 – **Contribution to the Study of Trypanosomiasis in Animals in Angola, West Africa.** — MONTEIRO DA COSTA ANTONIO in *Revista de Medicina veterinaria*, Year 14, No. 164, pp. 233-240. Lisbon, October, 1915.

The writer shows the presence of trypanosomiasis in cattle at Huambo nd identifies the species as *Trypanosoma congolense*.

90 – **On the Immobility of the Anthrax Bacillus.** — CARPANO, MATTEO in *Il Moderno Zooiatro*, Series V, Year IV, No. 11, pp. 446-448. Bologna, November 30, 1915.

Many works on bacteriology affirm that *Bacillus anthracis* is absolutely mmobile. Some writers (TOUSSAINT, NICOLLE and TRENEL DUPOND) have ecorded the contrary.

The writer has studied this question at the Army Veterinary Bacteriological Institute at Rome using Pasteur first and second vaccines and ither examining the material fresh or staining the cilia.

He found that: 1) in attenuated forms (vaccine) and in virulent forms cultivated in special media (of a nature ill adapted to its growth) the bacillus in the first few hours of its growth may exhibit limited but appreciable movements due to the presence of peritrichial cilia; 2) this bacillus may therefore be classified more closely with the other group of anthrax bacilli exhibiting more or less quick movements.

191 – **The Diagnosis of Glanders by Means of Coagulation Tests.** — MARCIS, ÁRPÁD in *Allatorvosi Lapok*, Year XXXVIII, No. 37, pp. 239-241, No. 38, pp. 245-247. Budapest, 1915.

According to the experiments of EHRLICH and SACHS fresh blood serum of cattle destroys the red corpuscles. BORDET and GAY have shown that bovine serum coagulates the corpuscles before destroying them. The serum is rendered inactive by warming on a waterbath at 56° C. for half an hour (which destroys the complement). On adding the serum of fresh horse's blood to the inactive serum it recovers its original properties. BORDET and GAY have therefore concluded that there exist in bovine serum thermostable substances similar to amboceptors. BORDET has named them "*conglutinines*" and their coagulating action "*conglutination*". Recently STRENG has shown that bovine serum is also capable of "conglutinating" bacteria.

These preliminary experiments suggested that this property of conglutination might be applied in serological work. KARWONEN, STRENG, HECHT, MIRONESEN and others have successfully applied this test to the diagnosis of syphilis, and LUGER has used the method in diagnosing typhus. Of recent years it has gradually found more favour in the diagnosis of glanders.

PFEILER and WEBER were the first to recognise the use of conglutination for diagnosing glanders and they recommended a very sinple process for carrying out the test. The writer describes this method in which an infected animal is detected by the absence of conglutination in its serum. In the serum of infected horses there are anticonglutinines which prevent conglutination of the corpuscles in question. The presence of the conglutinine reaction proves the absence of infection since the blood of healthy animals does not contain the specific substances preventing coagulation.

ANDERSEN, MICHIN, STRANIGG have carried out several experiments on this method confirming its suitability as elaborated by PFEILER and WEBER for determining infection by glanders.

The researches of MIESSNER and TRAPP have shown that the blood serum of healthy mules contains anticomplementary substances which more or less prevent the action of the complements. SCHUTZ and WALDMANN have also shown that the fixation of complements is not a very suitable process for the diagnosis of glanders in asses and mules. After examining the blood of a mule artificially infected and the blood of several healthy asses they found that this method was of great practical value.

With a view to testing the value of this serum method, experiments have been begun at the Epidemiological Institute of the Royal Veterinary High School at Budapest. During 1914 two horses were infected by means of a culture of *Bacillus mallei* obtained from 5 greyhounds. Before infection the blood of the horses was submitted to tests for agglutination, complementary fixation, conglutination and precipitation, with negative results in each case. The same tests were repeated each day after infection. The object of the experiment was to show: 1) the practical value of conglutination; 2) how long after infection the conglutination tests reveal the presence of glanders compared with the period required by other tests.

According to the results of the first series of experiments the agglutination test indicated the presence of glanders 3 days after infection whilst the fixation of complements test required 6 days and the conglutination test 8 days. Thus the agglutinines, the fixatives of the complements and the anticonglutinines require respectively 3, 6 and 8 days after infection to attain sufficient strength to reveal the disease. (One dose of 0.1 to 0.2 cc. of blood serum completely prevented the conglutination of the red corpuscles.

In the 2nd series of experiments the precipitation test indicated the presence of the disease in 3 days after infection, whilst agglutination and complementary fixation required 6 days and conglutination 9 days. Thus, of the specific antibodies formed in the blood of infected animals, the anticonglutinines multiplied last.

In other experiments the sera of 23 horses with glanders, of 26 healthy and of one doubtful case were submitted to the conglutination test.

The serum of 20 infected horses in doses of 0.1 to 0.2 cc. prevented conglutination of the red corpuscles, thus indicating the presence of glanders. In these 20 cases the complementary fixation and precipitation test failed once whilst the agglutination and conglutination tests always gave positive

esults. The serum of 26 healthy horses at the rate of 0.1 to 0.2 cc. caused onglutination, thus showing the absence of glanders. With the exception f one or two cases the agglutination, fixation of complements and recipitation tests did not succeed.

The conclusions drawn from these results are as follows.

The conglutination test of PFEILER and WEBER may be used in the diagnosis of glanders. It has the advantage that all the necessary substances re easy to procure, viz : bovine serum and horse complement.

Of the antibodies forming in the blood of animals subject to glanders he anticonglutinines appear latest and remain longest.

The conglutination test requires a period of 8 to 9 days for signs of nfection to appear.

Although spontaneous infection is more quickly detected by the conglulination method the writer considers it necessary to use also the other methods or a rapid diagnosis.

92 – **The Virulence of Rinderpest in Cattle.** — CARPANO, MATTEO (Bacteriological Institute of Milan) in *La Clinica Veterinaria*, Year XXXVIII, No. 23, pp. 901-915. Milan, December, 15, 1915.

The more important researches on rinderpest are summarised and the ollowing conclusions are drawn from the writer's own observations.

1) The blood of cattle infected either artificially or naturally may how no virulence during the 4th period of the disease and at death.

2) In treating animals for the production of anti-serum as well as seum-vaccine (serum and blood) they should be chosen in the 2nd or 3rd eriod of the disease when the blood is certain to be infected.

93 – **Effects of Tick Eradication on the Cattle Industry of the Southern Areas of the United States** (1). — WARD, W. F. (Bureau of Animal Industry) in *Special Bulletin of the U. S. Department of Agriculture*, 26 pp., 8 figs. Washington 1914.

This paper deals with the recent improvements in the cattle and pastures in the tick-free areas of the Southern States of North America and suggests methods of improvement which should be adopted as soon as ticks have been eradicated from any section. The most important of these are :

1) Improvement of the pastures by the sowing of suitable legumes or grasses such as lespedeza and bur-clover (*Medicago arabica* Huds.) on the uplands and alsike clover (*Trifolium hybridum*) white clover (*T. repens*) and *Paspalium dilatatum* on the bottom lands.

2) The improvement of the cattle and gradual elimination of the " scrub " type by the use of good bulls of the beef breeds.

Cattlemen and farmers throughout the States in question are unanimous in testifying to the advantages derived from the campaign organised by the Bureau of Animal Industry, whereby, in a period of 7 years, the tick has been eradicated from an area of 198.802 square miles, or from more than one-fourth of the whole area infected.

(1) See also *B.* April 1915, No. 400. (*Ed.*)

FEEDS AND FEEDING

194 – **Value of the Starch Equivalent System in Modern Feeding Practice.** — I. MURRAY, J. ALLAN (University College, Reading): The Starch Equivalent Theory, in *The Journal of Agricultural Science*, Vol. VII, Part 2, pp. 154-162. London, September 1915. — II. HALNAN, E. T. (Animal Nutrition Institute, Cambridge): The Maintenance Ration of Oxen and The Starch Equivalent Theory, *Ibid.*, pp. 163-174.

In a previous paper (1) Wood and Yule have examined the reason why British experimenters, calculating on the basis of Kellner's figures, usually find that the increases produced by various diets are not proportional to the excess of starch equivalent provided by the diets above that required for maintenance. The publication of this paper has stimulated the above named authors not only to an examination of the paper itself but also to a general discussion of the principles underlying Kellner's system of starch equivalents in the light of recent experience.

I. — It has hitherto been customary to assume that the requirements for maintenance of oxen were proportional to the live weights of the animals and could therefore be determined by rule of three, though it has long been known that this is not true. Wood and Yule have discarded this assumption and have determined the variation in the requirements of oxen of different sizes by means of a diagram which may be expressed numerically by the formula :

$$\log E = \frac{2}{3} \log M - 1.19723$$

where $M$ is the live weight of the animal and $E$ is the amount of starch equivalent required for maintenance. In such a formula, however, it is assumed that the difference in live weight is due in all cases to greater or less growth and not to fattening. Fat animals require more food to maintain them without gain or loss of weight. In an attempt to meet this difficulty the writer suggests the introduction into the formula of a factor $x$, which is a number that varies inversely as the fatness of the animal. This assumes that some method is found to express the degree of fatness in numerical terms. All that can be said at present is that when animals are in store condition — whatever that may be — the value of $x$ is 1 and when they are fatter it is less than 1. Possibly it is the above factor that is concerned in the gradually diminishing returns in the shape of increase for food consumed as the animal grows fatter.

The writer considers that a ration comprising two or more independent variables *e. g.* maintenance and fattening can no longer be calculated by a single arithmetical operation. Conversion of the nutrients into starch equivalents does not overcome the difficulty. The best results will be obtained when the digestible nitrogenous and non-nitrogenous nutrients are supplied in the proportions and quantities required for each specific purpose, *viz.*, maintenance, growth, work, fattening and lactation. The amounts required for maintenance depend upon the size of the animal and those for other purposes upon the rate of each kind of production, though probably in no case are they directly proportional to that rate. In each

(1) See B. Dec. 1914, No. 1147. (*Ed.*).

case the nutrients must be derived from a food suitable for the particular purpose, *e. g.* the nutrients for maintenance of oxen should be derived from cheap coarse fodders and those for fattening from the finest, most readily digestible materials. Nothing should be deducted from the former for the work of digestion, etc. From the latter there is nothing to deduct on this account, or at least, with one or two exceptions, the amount to be deducted is insignificant. If, however, the amounts of nutrients for the several purposes are not to be added together but directly translated into the corresponding amounts of appropriate kinds of food, it seems clear that they must be determined by a separate calculation in each case, and the *raison d'être* of the starch equivalent system disappears.

The present feeding standards should be superseded by formulae which should be in terms of « total digestible nutrients » with given albuminoid ratios for maintenance, growth, work, fattening and milk production. Although in the present state of knowledge such formulae could be little more than hypotheses they would serve to give point and direction to research.

II. — The writers finds it difficult to understand Murray's objection (in the paper above cited) to Wood and Yule's distinction between starch equivalent for maintenance and starch equivalent for production, especially since Murray himself admits the error of applying the term " starch equivalent " promiscuously to essentially different things and clearly shows the impossibility of completely defining starch equivalent for maintenance by starch equivalence for production alone.

Kellner's starch equivalents were intended to be used solely for estimating the relative fattening capacities of various foods and were not intended to be applied indiscriminately for the estimation of maintenance and also for the production of fat. The point is that the term starch equivalent in the sense used by Kellner is scientifically incomplete (1). Since Kellner meant by " starch equivalent " " starch equivalent for production " it is this latter expression that should be employed. There would then be no longer any danger of the starch equivalent for production of a food being used to express the maintenance starch equivalent.

The formula proposed by Murray, although possibly more scientifically accurate, will hardly appeal to a farmer who has already rejected Kellner's starch equivalent system on account of its complexity of application. The beauty of the Kellner system lies in the fact that it gives the comparative values and not the absolute values of feeding stuffs for fattening purposes. The farmer desires to know, not how much fat or milk a food will produce, but rather which of several foods is more economical for any purpose he has in view. It has yet to be proved that the starch equivalent system is incapable of giving him the right information on this point.

(1) Kellner's terminology has recently been the object of criticism from another point of view by Prof. Laur. See *B.* Dec. 1915, No. 1334. (*Ed.*).

195 – **Essential Factors in the Diet during Growth.** — Mc COLLUM, E. V. and DAVIS, MARGUERITE (Laboratory of Agricultural Chemistry of the University of Wisconsin) in *The Journal of Biological Chemistry*, Vol. XXIII, No. 1, pp. 231-246, 12 charts. Baltimore, Md., November 1915.

The results of previous workers, STEPP, HOPKINS, FUNK and others, have favoured the theory that in addition to proteins, carbohydrates, fats and salts there exist certain other accesory substances (at present unidentified) indispensable for growth or prolonged maintenance. The writers' present experiments afford additional support to this theory and show, furthermore, that there is a class of such accessories soluble in fats and another soluble in water and alcohol.

While the amount of these accessory substances required to induce growth is probably small, the evidence points to the belief that a certain quantity must be present before any growth can take place, and that above this amount growth seems proportional to the amount of accessories present.

It is obvious that in the study of the relative values of isolated proteins fed with mixtures of purified food substances comparable amounts of these two classes of accessories must be supplied. Otherwise no safe interpretation can be put upon the results.

196 – **Acidosis (Excess of Acids) in Omnivora and Herbivora and its Relation to Protein Storage.** — STEENBOCK, H. NELSON, V. E. and HART, E. B. in *Research Bulletin* 36, *Agricultural Experiment Station of the University of Wisconsin*. 19 pp., 6 tables. September, 1915.

Emphasis is continually placed upon the balance of acid and base forming elements in rations and upon the necessity of maintaining an excess of basic over acid radicals for normal nutrition. The part ammonia may play in maintaining tissue neutrality is, however, often disregarded.

Experiments were carried out with feeding acid rations to omnivora, as represented by swine, and to herbivora, as represented by calves. The ration fed to the swine consisted of grain alone or of grain supplemented by basal ration, that fed to the calves consisted solely of milk, the acidity of which was regulated by the addition of a mineral acid.

Acid rations fed to swine (omnivora) or calves (herbivora) occasion a rise in urinary ammonia with a compensative fall in output of urea. Presumably, with normal protein intake, a part of the ammonia, produced either in the intestine or liver, combines with acids and is excreted as the salts of these acids. This power to help maintain neutrality by the production or use of ammonia is apparently very general in all mammals.

Ammonia production, under conditions of exogenous protein-metabolism, does not occasion an increased nitrogen excretion or an interference with protein storage.

In herbivora (calves) approximate endogenous nitrogen metabolism likewise occasions a rise in urinary ammonia, without, however, (on the amount of acid used), causing a rise in protein katabolism, as has sometimes been observed with dogs and swine.

Data are also given on calcium and phosphorus metabolism both dur-

ing neutral and acid periods of low nitrogen intake, as well as on a period of high nitrogen intake. Only on a high acid ingestion did it appear probable that decalcification of the bones began and that there was then only a withdrawal of calcium carbonate.

From the results obtained it is believed that natural acid rations, if otherwise satisfactory, are as effective for growth or reproduction as those of basic character. Further evidence is needed, however, before making too sweeping conclusions.

197 - **On the Chemical Changes in the Intestinal Content from the Beginning of the Colon to the Rectum.** — MAESTRINI, DARIO in *Il Moderno Zooiatro*, Series V, Year IV, No. 11, pp. 452-460. Bologna, November 30, 1915.

The following points were investigated : 1) the quantity of water, total nitrogen and residue in the chyme of the different parts of the colon of ruminants (cattle and sheep) ; 2) the quantity of mineral matter in the various parts of the intestine of ruminants.

It was found that: 1) there is no digestion and absorption of proteins in the second half of the colon.

2) in sheep the maximum absorption of water occurs in the part of the intestine between the small intestine and the sigmoid flexure, whilst in cattle it occurs between the spiral colon and the rectum.

3) There is no direct relation between the absorption of water and the absorption of mineral matter; most water is absorbed in that part of the intestine in which the absorption of salts is least.

4) The maximum absorption of mineral matter occurs in the first portion of the colon.

198 - **The Composition and Food Value of the Seeds of Galium.** — BERNÁTSKY, JENÖ (Royal Hungarian Seed Station, Budapest) in *Kisérletügyi Közlemények* Vol. XVIII, Part 4, pp. 675-687. Budapest 1915.

In the siftings of wheat used as food for live-stock in Hungary there are often seeds of *Galium Aparine*, *G. Naillantii* and *G. tricorne*. It is therefore interesting to know the food value of these seeds and also in what manner the three species may be identified when the integument of the seeds has been removed in the siftings.

The results of anatomical and analytical analyses on the above three species of seeds lead to the following conclusions :

Of the three species of *Galium, tricorne* is most abundant in the wheat siftings in Hungary.

The products of *G. Aparine*, *G. Vaillantii*, *G. tricorne* and *G. palustre*, the spiny hairs or tufts of which are broken by the sifting can be identified anatomically. With the exception of *G. Vaillantii* the seeds of the other species of *Galium* may be identified even when they are deprived of their integuments. *G. tricorne* and *G. Aparine*, the two most important species from an economic point of view, may be distinguished by means of fragments.

The seeds of *Galium* may be considered as good food for cattle, but on account of their hardness they should be fed in a ground state so as to increase their digestibility. They may be fed to fowls without grinding.

The spiny hairs on the integument of the seeds of *G. Aparine* and of *G. Vaillantii* become broken in the sifting and therefore do not give rise to trouble in feeding. The seeds of *G. tricorne* are tufted rather than spiny.

In addition to the protein, carbohydrates and cellulose the seeds of *Galium* contain from 1 to 2 per cent of oil finely divided in the tissues, thus rendering its extraction and determination very difficult.

199 – **Calculation of the Percentage of Molasses in Molassine Feeds.** — BLANCK, E. in *Die landwirtschaftlichen Versuchsstationen*, Vol. 87, No. 1, pp. 25-28. Berlin, 1915.

In Germany, the percentage of molasses contained in mixed cattle foods is calculated according to a formula devised by NEUBAUER (1) and is based on a constant representing the weight of water soluble substances contained in 1 gm. of the dry matter. Since sesame cake is often used as a matrix for the molasses it is important to know the value of this constant for different kinds of sesame cakes.

The following are the results of six kinds :

| Cake No. | Percentage of water. | Specific Gravity | Value of Constant. |
|---|---|---|---|
| 1 | 6.07 | 1.00505 | 0.0541 |
| 2 | 6.69 | 1.00475 | 0.0512 |
| 3 | 7.48 | 1.00565 | 0.0615 |
| 4 | 7.03 | 1.00590 | 0.0639 |
| 5 | 5.61 | 1.00580 | 0.0618 |
| 6 | 7.60 | 1.00455 | 0.0496 |

The mean value of the constant is 0.057. The differences in the values of the constant are analogous to those found by NEUBAUER for palm cakes and maize germs. The relation between the percentage of fat and the constant has not yet been determined.

The average of the six constants only differs slightly from any of the six values and can therefore be taken as the constant for sesame cake generally.

BREEDING

200 – **Observations on the Skulls of Hybrids between Wild and Domestic Horses and Cattle.** — PHILIPTSCHENKO INR (Zoological Station of the Minister of the Interior at Oskania Nova, Russia), in *Comptes Rendus hebdomadaires des Séances de la Société de Biologie*, Vol. LXXVIII, No. 18, pp. 636-638. Paris, December 3, 1915.

The skulls of the following hybrids were studied : 1) hybrids between ordinary cattle and species of Bison, viz : American bison (*B. americanus*) and "zubr" (*B. bonasus*) ; 2) hybrids between horses and zebra.

In the first series were skulls of a halfbred "zubr" (½ Z), of a ¾ bred bison (¾ B) of a halfbred bison (½ B) and of a ¼ bred bison (¼ B). For purposes of comparison the skulls of the following were measured : a "zubr" (Z), a bison (B), a bull and a cow of the Ukraine breed (U ♂, U ♀) to which the mothers of all these hybrids belonged.

In the second series are the measurements of the skulls of two zebroids obtained by crossing *Equus chapmani* ♂ with the horse ♀ (½ Z) and for

(1) H. NEUBAUER in *Die landwirtschaftlichen Versuchsstationen*, Vol. 51, p. 421. Berlin, 1899.

purposes of comparison the skulls of the male zebra (Z) used as male parent of these hybrids and of a horse of the local breed (H).

The most characteristic measurements are given in the form of ratios in the following table for the bison hybrids:

| | U ♂ | B ♂ | Z ♂ | 1/2 Z ♂ | 3/4 B ♂ | 1/2 B ♂ | 1/4 B ♀ | U ♀ |
|---|---|---|---|---|---|---|---|---|
| 1) Average height of skull / Basal lentgh . . . | 31 1/4 | 38 1/4 | 37 | 32 | 35 1/2 | 33 1/2 | 32 1/2 | 30 3/4 |
| 2) Height of temporal fossa / Length . . . | 41 3/4 | 21 1/2 | 22 3/4 | 27 | 24 | 29 1/2 | 32 1/2 | 37 |
| 3) Maximum length of forehead / Length . . . | 96 | 122 1/2 | 117 | 97 | 119 | 11 1/2 | 95 1/2 | 93 1/2 |
| 4) Breadth of nasal bones / Breadth of muzzle . . . | 19 1/2 | 31 1/2 | 31 | 29 | 25 1/4 | 23 1/2 | 21 3/4 | 17 3/4 |
| 5) Length of temporal fossa / Breadth of forehead . . . | 57 1/4 | 83 1/2 | 79 3/4 | 76 1/4 | 72 1/2 | 70 | 70 | 61 1/2 |
| 6) Distance between intermaxillary bones and nasal bones . . . mm | 0 | 44 | 38 | 8 | 39 | 7 | 8 | 0 |
| 7) Height of occiput / Basal length . . . . . | 37 1/4 | 28 | 26 | 27 | 27 | 27 3/4 | 35 | — |

The above ratios show the blending of characters in the hybrids and corresponding more or less to the quantity of wild blood.

There is however a slight tendency to segregation and with regard to the 7th character there is complete resemblance between the quarter and half-bred hybrids. Possibly this is a case of combination of blending and segregating inheritance, which would also result from the general conformation of the hybrids.

With regard to certain characters (3-4-5) the half-bred " zubr " is distinct from the half-bred bison although the pure bred wild forms resemble each other.

In some cases of halfbred " zubrs " the characters of the ordinary bull are dominant over those of the " zubr " and in other cases the contrary occurs. The half-bred bison however appears intermediate in form between its wild and domestic parents. This may be accounted for by the varying prepotency of the " zubr " characters and perhaps by the occurrence of segregation in the first generation as already noticed in other species.

*Cranial Measurements of Zebroids.*

| | H ♂ | ½ Z ♂ | ½ Z ♀ | Z ♂ |
|---|---|---|---|---|
| 1) Basal Length . . . . . mm | 545 | 504 | 534 | 474 |
| 2) Posterior part of base of skull: Length of palate | 83 1/2 | 85 | 86 1/2 | 91 1/2 |
| 3) Length of space without teeth: Length of row of teeth. . . . . | 70 | 54 1/4 | 60 3/4 | 59 1/2 |
| 4) Ocular index, NEHRING. . . . . | 195 | 195 | 164 1/2 | 178 |
| 5) FRANK's index . . . . . | 98 1/2 | 98 1/2 | 109 | 97 1/2 |

With regard to the general size of skull the zebroids take an intermediate place between the parents. Several other measurements have the same character, *e. g.*, the basal length.

In certain ratios (*e. g.* 2 and 3) there is a dominance of the horse and in others of the zebra. Also, there is a resemblance to segregation (as occurs in the stripes) when corresponding characters in the two animals are considered. This occurs in the case of the indices of NEHRING and FRANCK in the zebroid male which are the same as in the horse. In the female zebroid they are pronouncedly zebra in type.

Thus the inheritance of skull characters shows the usual complexity found in hybrids between species. For a more complete elucidation of this inheritance special investigation on more favourable subjects are necessary.

201 – **Researches on the Transmission of Epilepsy in Animals.** — HINK, AUGUST in *Deutsche Tierärztliche Wochenschrift*, Year 23, Vol. 41, pp. 351-352. Hanover, October 9, 1915.

The theory of the transmission of acquired characters is based generally on BROWN SEQUARD'S experiments on the transmission of epilepsy induced by a spinal lesion. As these experiments have been and are still much subject to criticism they have been repeated on a large scale by WRZOSEK and MACIESZA of Cracow. In these experiments 123 guinea pigs were used. They were narcotised by means of alcohol, ether or chloroform before wounding the spinal cord at the last dorsal vertebra.

The following results were obtained :

1) It is impossible to induce complete epilepsy in all guinea pigs by wounding the spinal cord. When complete epilepsy is obtained the animal generally succumbs to the repeated nervous attacks, but in some cases the attacks subside after a time.

2) Lesion of the cord due to pricking brings on the epileptic attacks later than that induced by cutting, in which latter case the female becomes epileptic quicker than the made

3) In many animals lesion of the cord by pricking results in the formation in the posterior extremities of abscesses resembling those caused by section of the ischiatic nerve.

The cases of complete epilepsy do not show this disturbance.

4) In several guinea pigs the epileptic attacks occurred immediately after the operation. The writer considers that these cases are due not to the operation itself but to the effects of the narcotic used.

5) The guinea pigs of epileptic parents (one or both) suffered more rapidly from the attacks of epilepsy after lesion of the cord than did their parents.

In no case was the epilepsy transmitted to the offspring, thus contradicting the experiments of BROWN SEQUARD.

202 – **Herd Books of the Argentine Rural Society.** — *Anales de la Sociedad Rural Argentina*, Year L, Vol XLIX, pp. 425-427. Buenos Aires, September-October 1915.

STOCK RAISING: ORGANISATION AND ENCOURAGEMENT

The adjacent tables give a summary of the entries in the herd books of the Argentine Rural Society since its foundation and a detailed account for 1914. All the pure breeds of cattle, horses, sheep and pigs produced or imported into the Argentine are included.

*A. — Argentine Herd-Book.*

| Breeds | Entries 1st October 1914 to 30 September 1915 | | | | Entries since its foundation | | |
|---|---|---|---|---|---|---|---|
| | Imported animals | | Animals born in the country | | Imported and native animals | | |
| | Males | Females | Males | Females | Males | Females | Total |
| Shorthorn . . . . . | 218 | 81 | 3 755 | 3 571 | 40 860 | 44 162 | 85 022 |
| Hereford . . . . . | 3 | — | 583 | 639 | 8 046 | 10 238 | 18 284 |
| Aberdeen Angus . . . | 9 | — | 365 | 356 | 3 394 | 3 756 | 7 150 |
| Red Shorthorn . . . . | — | — | — | 1 | 130 | 189 | 319 |
| Red Polled . . . . . | — | — | 11 | 8 | 86 | 100 | 186 |
| Devon . . . . . | — | — | 4 | 2 | 14 | 18 | 32 |
| Jersey . . . . . | — | — | 10 | 4 | 23 | 29 | 52 |
| Flamenco . . . . . | 6 | 18 | 98 | 411 | — | 429 | 533 |
| Totals . . . | 236 | 99 | 4 826 | 4 992 | 52 657 | 58 921 | 111 578 |

## *B. — Argentine Stud-Book.*

| Breeds | Entries from 1st October to 30 September 1915 | | Entries since its foundation | | |
|---|---|---|---|---|---|
| | Males | Females | Males | Females | Total |
| Percheron | 251 | 312 | 2 025 | 5 134 | 7 159 |
| Clydesdale | 137 | 221 | 1 697 | 4 474 | 6 171 |
| Shire | 107 | 206 | 1 485 | 3 035 | 4 520 |
| Hackney | 177 | 204 | 1 617 | 2 505 | 4 122 |
| Yorkshire | 28 | 53 | 236 | 653 | 889 |
| Anglo-Norman | 10 | 29 | 175 | 621 | 796 |
| Suffolk-Punch | 4 | 11 | 167 | 479 | 646 |
| Hunter | 6 | 23 | 126 | 170 | 296 |
| Boulonnaise | 9 | 13 | 81 | 101 | 182 |
| Orloff | 4 | 7 | 40 | 130 | 170 |
| Polo-Pony | 4 | 3 | 59 | 69 | 128 |
| Belgian | 3 | 4 | 19 | 66 | 85 |
| Oldenburg | 2 | 2 | 9 | 22 | 31 |
| Shetland-Pony | 1 | 3 | 9 | 13 | 22 |
| Holstein | — | 1 | 9 | 11 | 20 |
| American Trotting | — | — | 3 | 16 | 19 |
| Trakehnen | — | — | 3 | — | 2 |
| Totals | 743 | 1 092 | 7 759 | 17 499 | 25 258 |

## *C. — Argentine Flock Book.*

| Breeds | Entries from 1st October 1914 to 30 September 1915 | | | | | | Number of breeding animals on the books (including provincial entries) at the same period | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Imported animals | | Animals born in the country | | Provisional register | | Definite | | Provisional | |
| | Males | Females | Males | Females | Inspected | Presented | Males | Females | Males | Females |
| Lincoln | 98 | 5 | 2 383 | 2 736 | 1 035 | 1 932 | 1 880 | 8 189 | 115 | 6 302 |
| Merino, Argentine | — | — | 891 | 1 150 | — | — | 1 218 | 2 994 | — | — |
| Shropshire Down | 8 | — | 38 | 86 | — | 66 | 41 | 135 | 42 | 408 |
| Oxford Down | 11 | — | 20 | 19 | 40 | 350 | 30 | 101 | 13 | 814 |
| Romney Marsh | 9 | 80 | 29 | 23 | 163 | 90 | 41 | 85 | 10 | 571 |
| Hampshire Down | 2 | — | 80 | 118 | 94 | 106 | 103 | 318 | 6 | 201 |
| Border Leicester | — | — | 16 | 12 | — | — | — | — | — | — |
| Leicester | 1 | 8 | 11 | 4 | — | — | — | — | — | — |
| Total | 129 | 93 | 3 468 | 4 148 | 1 332 | 2 544 | 3 313 | 11 822 | 186 | 8 296 |

*D. — Argentine Swine-Book.*

| Breeds | Entries from 1st October 1914 to 30 September 1915 | | | Entries since its foundation | | |
|---|---|---|---|---|---|---|
| | Males | Females | Total | Males | Females | Total |
| erkshire . . . . . | 994 | 1 073 | 2 067 | 3 262 | 3 864 | 7 126 |
| iddle White Yorkshire . . . | 81 | 110 | 191 | 1 265 | 1 718 | 2 983 |
| arge Black . . . . . | 88 | 83 | 171 | 1 082 | 1 198 | 2 280 |
| oland-China . . . . . | 55 | 61 | 116 | 86 | 93 | 179 |
| amworth . . . . . | 24 | 36 | 60 | 45 | 7 | 123 |
| arge White . . . . . | — | — | — | 43 | 67 | 110 |
| uroc-Jersey . . . . . | 6 | 3 | 9 | 25 | 30 | 55 |
| incolnshire . . . . . | — | — | — | — | 1 | 1 |
| Totals . . . | 1 248 | 1 366 | 2 614 | 5 808 | 7 049 | 12 857 |

93 - **Dairy Breed Statistics in the United States.** — Mc Alister, Harold in *The Breeder's Gazette*, Vol. LXVIII, No. 23, pp. 1006-1008, Chicago, December 2, 1915. CATTLE

The growth of the membership of the three leading dairy breed associations in the last six years affords data for estimating the opinions of American dairymen as to the relative merits of the different breeds. The numbers of members were as follows :

| Years | Holstein Friesian | Jersey | Guernsey |
|---|---|---|---|
| 1909 . . . . . | 3 310 | 440 | 306 |
| 1911 . . . . . | 4 280 | 464 | 313 |
| 1912 . . . . . | 4 997 | 480 | 344 |
| 1913 . . . . . | 5 429 | 508 | 367 |
| 1914 . . . . . | 6 608 | 531 | 435 |

From the above figures it will be noted that the Holstein association has doubled the number of its members in five years and that over 93 per cent of the total number of breeders have given the preference to Holsteins.

The prices that the different breeds have averaged at auctions afford another proof of the breed's popularity.

The average prices which Holstein and Jerseys brought in the last three years are as follows :

| | | No. of sales | No. of animals sold | Average prices |
|---|---|---|---|---|
| Holsteins | 1912 . . . . | 33 | 4 170 | $195.00 |
| | 1913 . . . . | 49 | 4 529 | 246.00 |
| | 1914 . . . . | 69 | 5 927 | 265.00 |
| Jerseys . | 1912 . . . . | 77 | 5 285 | 174.65 |
| | 1913 . . . . | 74 | 3 873 | 159.90 |
| | 1914 . . . . | 60 | 3 703 | 133.35 |

While the average price of the Jersey has declined $41 in the last three years, the average price of Holsteins has gone up $70.

The Guernsey and Ayrshire sales have been so few that it is not possible to make any comparison between their average prices and those of the other breeds.

For 1915 it seems as if the prices of Holsteins have advanced more than in any other year. In the first sale of the year 173 animals were sold for an average of $866, and 10 animals sold for prices exceeding $2 725. Another indication of the popularity of a breed is the number of bulls registered by the different breed associations. There were 21 040 Holstein males registered in the last year, 9 944 Jerseys and 3 839 Guernseys. There are now approximately over twice as many Holstein grades in the United States as of any other breed, while in 1898 the Department of Agriculture estimated that there were 50 per cent more Jerseys than Holsteins in the country.

SHEEP

204 – **Features of the Sheep Industries of the United States, New Zealand, and Australia Compared.** — MARSHALL F. R. (Senior Animal Husbandman in Sheep and Goat Investigations, Animal Husbandry Division) in *United States Department of Agriculture, Bulletin* No. 313, 35. pp., 8 plates. Washington, D. C., November, 13, 1915.

In addition to forming a general survey of the sheep industry in Australia and New Zealand the paper discusses the various points of divergences between the industry in those two countries and the United States with the object of affording comparisons useful to the American husbandman.

### *Sheep husbandry in New Zealand.*

In comparison with American farm flocks, those of the smaller holdings in New Zealand have an advantage in that they rarely number less than 400 head and are a very important if not the chief source of revenue from the holdings. The following table contrasts N. Z. figures with the leading farm-sheep State and the leading range-sheep State in U. S. A.

*Sheep in New Zealand, Ohio and Wyoming.*

| State | Total land area | Sheep in State (1) | Holdings over 100 acres (2) | Holdings having sheep | Average size of flock |
|---|---|---|---|---|---|
| | Acres | Number | Number | Number | Number |
| New Zealand . . . . . | 66 292 232 | 24 595 405 | 25 702 | 21 527 | 1 124 |
| Ohio . . . . . | 26 073 600 | 3 263 000 | 94 754 | 71 556 | 55 |
| Wyoming . . . . . | 62 459 160 | 4 472 000 | 9 584 | 1 643 | 2 938 |

(1) Jan. 1, 1914. — (2) In 1910.

Though it is partly of necessity that New Zealand lands are so largely devoted to sheep raising the place occupied by sheep is evidence of the profits obtained when valuable lands are devoted to well managed flocks of sufficient size to ensure careful tending. The advantage enjoyed in N. Z. in the price of wool is largely due to the superior skill in preparing clips for the market. The main difficulty in the way of an improvement in the industry of the Middle and Eastern States of U. S. A. is lack of appreciation of the results obtainable from carefully tended flocks.

### *Sheep husbandry in Australia.*

Table II compares the size of holdings and of flocks in New South Wales and Victoria with those of the Western United States.

*Sheep in N. S. Wales, Victoria and the western part of the United States.*

| Region | Total area | Total area owned (Farms) | Per cent of area having 15 inches rainfall or less | Area under lease or license | Total acres in holdings over 100 acres |
|---|---|---|---|---|---|
| | Acres | Acres | Per cent | Acres | Acres |
| New South Wales . . | 198 054 420 | 57 818 023 | 39.9 | 124 590 163 | 181 195 753 |
| Victoria . . . . . | 56 245 760 | 31 055 920 | 37.0 | 14 443 191 | 44 502 618 |
| Rocky Mountain States | 398 599 680 | 47 016 786 | 72.0 | — | 45 155 275 |
| South Western States . | 319 175 040 | 124 951 701 | 15.0 | — | 113 281 343 |
| Pacific States . . . . . | 204 580 800 | 57 328 789 | 37.0 | — | 48 027 762 |

| Region | Total sheep | Sheep per acre on holdings over 100 acres | Number of flocks | Average size of flock | Sheep in flocks over 1000 |
|---|---|---|---|---|---|
| | Number | Number | Number | Number | Per cent |
| New South Wales . . . | 38 855 861 | 0.21 | 24 549 | 1 520 | 84.5 |
| Victoria . . . . . | 11 892 224 | .25 | 24 838 | 480 | 59.7 |
| Rocky Mountain States | 18 196 574 | .308 | 11 323 | 1 607 | 86.8 |
| South Western States . | 6 382 426 | .056 | 11 881 | 537 | 80.6 |
| Pacific States . . . . . | 5 592 167 | .116 | 11 368 | 452 | 89.7 |

In Australia the flocks are not kept collected under the care of herders while pasturing but the lands are fenced into "paddocks" of from 500-1000 acres in size. The labour and expense required by this method is more

than counterbalanced by subsequent saving in the labour of handling the flocks and in the extra thrift of the sheep.

*Tenure of grazing lands.*

In large part the success of the Australian pastoralist is due to the system under which he holds his grazing lands. The Australian pastoralist who pays for the use of his lands according to a long time contract is at a great advantage over the American pastoralist who argues that an investment in improved stock or in the appliances and intelligence required to secure a good reputation for his product cannot be safely undertaken because of the uncertainty of his remaining in business long enough to reap the profits. A definite policy for control and improvement of the public grazing lands is urgently needed in America.

*Breeds and Types of Sheep in Australia and New Zealand.*

A point of considerable interest is the divergence of Australian and American Merino standards. Australians are said to be familiar with the so-called "Vermont" sheep and the use of that blood has been discontinued. Both are derived from the same original stock. Objection is made to the excessive wrinkles on the body, to exceess of oil in the wool, to shortness and too great fineness of the wool. These features are considered to be indicative of a lack of constitutional vigour. Considerable space is given to the consideration of Australian standards.

As regards carcass value the American Merino is not inferior to the Australian Merino in either size or points of mutton conformation. In both regards the latter is inferior to the Rambouillet as bred in the United States. This latter breed is little known or understood in Australia.

Attention is drawn to the huge prices paid for stud sheep in Australia. These are made possible by the patronage of a large number of owners of big commercial flocks who know that $500 or $1000 invested in an exceptional ram is more than returned in the fleece values of the great number of sheep tracing descent to such a ram in a few years.

The use and popularity of the mutton breed in Australia is on the increase. The Lincoln, Border Leicester, Leicester and Romney Marsh breeds are all in demand. The Cotswold is little known. The down breeds are favoured most by those who market their lambs before they are a year old and of these only the Shropshire and Southdowns are widely known.

The Corriedale is gaining ground in Australia and is still extensively bred in the South Island of New Zealand where it was first produced. It was to study this latter breed with a view to a trial importation into America that the writer visited New Zealand. The breed's greatest promise of usefulness in U. S. A. is for those localities which need and can support sheep of more carcass development than the Merino and in which the wool is to be relied on for at least one-half of the flock income. The experi-

ments which the U. S. Bureau of Animal Industry will conduct with the breed will be designed to test the herding instinct (not considered under the Australasian paddock system) its ability to thrive on various types of western ranges and the extent to which it can impress its features upon the sheep now bred in the section where such a type as the Corridedale seems desirable.

*Shearing and Wool Classing.*

The practices of American and Australasian wool growers differ more in respect of the handling of the shorn wool than in any part of their work. In the United States the wool is not infrequently sold before it is shorn. Even when this is not the case the sheep are not sorted for shearing and the entire fleeces are sacked just as they run. In disposing of the wool there is no possibility of fixing a price upon the amount of each of the various classes of wool in the sacks but bargaining must be done upon the basis of the clip as a whole.

Practically all the Australian and New Zealand wool remains the property of the grower until sold to the manufacturer. The cost of actual shearing constitutes only about one half of the amount expended in preparing the wool. The Australian system of shearing, classing and marketing wool is discussed at length and the possibility and advisability of the adoption of such a system in the United States.

The paper concludes with references to the Co-operative shearing sheds in New Zealand, Agricultural Education in Australia, Sheep-raisers' Organisations, etc. As regards the influence of the possible future development of the Australian mutton and wool industry on the American market, there is no reason for anticipating an increase in these products reaching the United States sufficiently large to affect seriously market values.

05 – **Ancestry of the Goat.** — *The Journal of Heredity.* Vol. 6, No. 11, pp. 519-524, 3 figs. Washington, D. C. November 1915. GOATS

The domesticated European goat can trace his pedigree back to a single form and is not the combination of a number of distinct species as is the case with the horse, the ox, the dog etc. The first goat fossils are found in Pliocene or late Tertiary deposits in the Punjab and the Siwalik hills of India and are of species allied to those now living in the Himalayas. In the succeeding or Pleistocene epoch, remains of an ibex, one of the best-known wild goats, are found in the plains of Central Europe.

The distinction between sheep and goats was thus made at a comparatively late geological period and even now it is not a broad one and it has been frequently proposed to consider them as a single genus.

The question whether the two species breed together and result in fertile offspring has received contradictory answers; it seems fair to say that interbreeding of the sheep and goat if it exists is at least very rare, whereas the different species of wild and tame goats interbreed freely and yield perfectly fertile progeny. Hence from a phylogenetic point of view sheep and goats are to be considered as two distinct genera.

The goat genus *Capra* is generally credited with a dozen species, of which *Capra hircus aegagrus* (Bezoar, Pasang or Grecian Ibex) is generally regarded as the ancestor of European, and thence American, domesticated goats.

Once common throughout Greece and Asia Minor, it still lives on a few of the Mediterranean Islands, notably on the slopes of Mount Ida in Crete. Its habitat today is Persia, Afghanistan and Beluchistan and in the mountains of Asia Minor. The Pasang is easily domesticated and its first domestication probably took place in Western Asia, thence it was carried over into Africa where it has departed very widely from the original type. No one can say with confidence whether it was from Asia or from Africa that it was introduced into Europe. Its remains are abundant in the early period of the Swiss lake dwellings.

The goat of the Swiss lake dwelling was somewhat smaller than the modern animal and had horns. In the Bronze age the goat seems to have been larger than in the Stone Age. In the Roman period a distinctly new form appears, unquestionably the result of conscious breeding and artificial selection and closely resembles some of the types still to be found in Switzerland.

With the spread of the breeding of goats in many lands a number of different changes have been produced in their appearance, among which one of the most important was the disappearance of the horns. Breeders have encouraged variations especially in two directions: to improve the yield of milk and to improve the yield of hair. The best milk breeds have been obtained in Switzerland (Saanen and Toggenburg) while the best hair breeds are those of Asia Minor (Angora).

The number of goats under domestication in the world is estimated at 80 000 000 of which 20 000 000 are in Europe. From the most distant times the goat has been the "poor man's cow" and has been replaced by sheep with the increase of prosperity. In the United States, with the exception of the large Angora herds in the western States, goats are generally kept only in small herds.

PIGS

206 – **Fecundity and the Relation between Male and Female Descendents in Improved German Pigs.** — MACHENS, A, in *Berliner Tierärztliche Wochenschrift*, Year 31, No. 47, pp. 559-562. Berlin, November 25 1915.

The writer set out to determine:

1) The fecundity of the improved German pig during its sexual life.

2) The ratio of males to females in the various litters.

3) The influence of the number of young at a litter on the ratio of males to females.

4) The influence of the period of birth on the number and sex of the young.

For the purpose he studied the Herd-Book of the Breeders' Syndicate of the Duchy of Brunswick where the improved German breed is reared.

A total of 3464 offspring were studied with the following results:

1) The average number per litter is 9.56, the maximum generally being reached at the 4th litter. A larger number may sometimes be born

n the 7th and 8th litters but only in the case of sows of exceptional ertility.

2) The first litter of a young sow generally contains more males than emales, whilst in the later litters there are more females. Generally after he 5th litter the females predominate.

3) In 46 litters (12.8 per cent of those studied) the number of young vas 10 ; in 181 litters (50 per cent) it was less than 10 ; in 135 litters (37.2 per cent) it was greater than 10. The number of young per litter influences he sex, in the sense that in small litters there are more males and in the arge litters more females.

4) The best periods for births are: February, November, January, April and October. During the cold period September to March the fecunlity is higher (9.7 per litter) than in the warm period during the rest of the year, when it is 9.4 per litter. In accordance with the observations already nade by WILCKENS, FRÖLICH and GEORGS, more females were born during he cold period than during the warm period.

POULTRY

207 – **The Physiological Relationship between the Yellow Pigment of the Hen and the Xanthophyll of Plants.** — PALMER, LEROY S. (Dairy Chemistry Laboratory, University of Missouri, Columbia), in *The Journal of Biological Chemistry*, Vol. XXIII, No. 1, pp. 261-279, 1 plate, 3 tables. Baltimore, Md., November 1915.

The pigmentation of the egg-yolk and of the body fat of poultry is a subject of much practical importance to the trade, and the yellow pigment characterising the skin of hens has been shown to be of considerable value n judging egg-laying activity. Experiments were carried out in order to furnish definite evidence of a physiological relation between the plant xanthophyll and the natural egg-yolk pigment, such experiments finding practical application in the control of the colour of the flesh of fattening poultry, and the control of the amount of natural pigment deposited in the egg-yolk.

The natural pigment characterising the egg-yolk, body fat, and blood serum of the hen is physiologically identical with the carotin and xanthophyll pigments of plants, with the latter class of pigments present in by far he greater proportion. This is different from the utilisation of the plant carotin and xanthophylls by the cow, where the carotin is the predominating pigment found in the milk fat, body fat, and blood serum. Feeding tests with laying hens in which the pigment of the feed was carotin to the relative exclusion of xanthophyll were without appreciable influence upon the amount of pigment carried by the blood serum and deposited in the egg yolk. The feeding of rations relatively free from both carotin and xanthophyll to laying hens resulted in a marked reduction of the amount of this pigment carried by the blood serum and deposited in the egg-yolk.

208 – **Measurement of the Winter Cycle in the Egg Production of Domestic Fowl.** — PEARL, RAYMOND, (Biologist, Maine Agricultural Experiment Station) in *Journal of Agricultural Research*, Vol. V, No. 10, pp. 429-437, 8 tables. Washington, D. C., December 6, 1915.

The writer has previously shown that there are to be distinguished definite cycles in the egg-laying activities of the fowl, the most striking of which

are those of winter and spring. As a measure of the winter cycle of productivity is taken the record of production up to the first March, following the individual's birth. The point now arises whether a better measure of the winter cycle of productivity might not be obtained by using the egg-production of a bird up to the time it has attained a definite age, since the egg-production up to, say, 300 days of age of the bird will include the winter cycle and will also allow for differences in the time of hatching.

The statistical evidence presented in the present paper shows that whatever superiority there is of one of these measures over the other is entirely in favour of the production to March 1 ; that is, with flocks of poultry having average hatching dates falling somewhere within the month of April. It results, therefore, that the use, in investigations on fecundity, of the record of egg production to March 1 of the pullet year as a measure of the winter cycle of production is fully justified.

209 – **Poultry Breeding.** — SLOCUM, ROB R. (Scientific Assistant in Poultry Investigations, United States Department of Agriculture, Washington, D. C.) in *The Journal of Heredity*, Vol. VI, No. 11, pp. 483-487, 3 plates. Washington, D. C., November 1915.

This paper is a summary of the results obtained in the experimental work which has been carried on in breeding poultry in the last twenty five years, and a discussion of their value for practical poultry keeping.

Following the rediscovery of Mendel's laws in 1900 there was begun and has since been continued a considerable deal of experimentation on the heredity of characters in poultry. The first work along this line was that of WILLIAM BATESON. In the United States the Carnegie Institution's Department of Experimental Evolution at Cold Spring Harbour, Long Island N. Y. under the direction of C. B. Davenport, has been especially active along these lines. These studies have justified the conclusions to be drawn that in poultry the transmission of characters agrees with the theory based on Mendelian laws, that certain characters are inherited in a manner known as sex-limited and that the dominance and recessiveness of the common characters of poultry are those given in the accompanying table.

As will be noted from this table, in only a few cases is dominance listed as complete. A fact worthy of attention is that in the Andalusian neither the black nor the splashed white shows dominance over the other, but both exist side by side in the hybrid in a minute mosaic, which causes the blue colour. The blue individual is therefore always heterozygous or mongrel. Recent studies show that the caracter " bare-neck " is dominant over " feathered neck ".

One of the best-known examples of sex-limited inheritance is the barred colour pattern of the Barred Plymouth Rock. In order to explain this according to Mendel's laws, the female is considered to be heterozygous both for sex and for barring, while a repulsion is assumed between the determiners for these two characters, which prohibits their occurrence in the same gamete. The male is considered to be homozygous in respect to sex and either homozygous or heterozygous in respect to barring The females therefore inherit barring from their sire alone. A number of different crosses have been made which support this hypothesis, *e. g.*: Black

*Table showing the Mode of Inheritance of Some of the Common Characters of Poultry.*

| Dominant | Recessive | Remarks |
|---|---|---|
| Dominant white (Leghorn) | Black, red, buff | Almost complete dominance |
| Black, red, buff | Recessive white (Minorca) | » » » |
| » (Hamburg, Minorca) | Red, buff (Wyandotte) | » » » |
| Barred plumage pattern | Recessive white, black self colour | Sex-limited inheritance |
| Game pattern (Leghorn) | Recessive white (Minorca) | » » |
| Black self colour (Minorca) | Hackle lacing (Brahma) | Imperfect dominance |
| Plain feathering | Silky feathering | Complete » |
| Frizzle feathering | Normal repent feathering | » » |
| Rose or pea comb | Single comb | » » |
| Single comb | Comblessness (Breda) | » » |
| Crest (Silky) | No crest | Imperfect » |
| Normal head | Cerebral hernia (Polish) | » » |
| Rumplessness | Normal uropygium | » » |
| Extra toes | » foot | » » |
| Joining of toes | » » | » » |
| Silky pigmentation | » mesoderm color | » » (*) |
| Yellow skin colour | White skin » | Complete » |
| » shank » | Light shank » | » » |
| Dark shank » | » » » | » » |
| Black iris » | Brown, red, pearl iris | » » |
| Red ear-lobe | White ear-lobe | Imperfect » |
| Feathered shanks | Clean shanks | » » |
| Plain heel | Vulture hock (Silky) | » » |
| Booting (Silky) | No booting | » » |
| Beard (Houdan) | No beard | Almost complete dominance |
| Long tail (Japanese) | Normal tail | Imperfect » |
| Rapid feathering | Slow feathering | Almost complete » |
| Broodiness (Silky) | Non-broodiness | » » » |

(*) Sex-limited in Brown Leghorns and Silky crosses.

Langshan × Barred Plymouth Rock; Cornish Indian Game × Barred Rock; White Cochin × Tosa; and Barred Plymouth Rocks with: Campines, Golden Pencilled Wyandottes, Black Hamburg, White Wyandottes, and White Plymouth Rocks.

Sex-linkage has been reported in a number of other instances, such as an inhibiting factor influencing the mesodermal pigmentation of the Silky, Brown Leghorn colour pattern, an inhibition for red in the plumage of the Columbian Wyandotte, the gray of the White Wyandotte and the factor on which high fecundity depends.

For about nine years, from 1898, systematic breeding experiments were conducted with the object of increasing the average egg production of the poultry. The results obtained led Dr. RAYMOND PEARL to the hypothesis that the factor for high egg production behaves as a sex-limited character. According to this hypothesis the female is heterozygous for sex and also for the factor of high fecundity and these two factors cannot be present in the same gamete. This conclusion is based on the belief that high egg production is a unit character. But the results of eight years' work at the Utah Station do not confirm this conclusion and the results attained at the Massachusetts Agricultural Station indicate that high egg production is a compund, not a single trait (1).

BEES

210 – **Outdoor Wintering of Bees.** — PHILLIPS, E. F. and DEMUTH, GEORGE S. in *U. S. Dept of Agriculture, Farmer's Bulletin*, No. 695, 12 pp. Washington, D. C., October 12, 1915.

The causes, variously assigned, of the death of individual bees or of a colony of bees in winter, excluding unusual accidents, are capable of classification under two headings only: 1) inadequate stores, and 2) excessive

(1) The following is a list of the United States Experiment Stations that deal with poultry breeding and of the studies conducted by them.

*Purdue University Experiment Station, Lafayette, Indiana*: The influence of heredity on egg-laying.

*Kansas Experiment Station, Manhattan, Kansas*: Study on the value of pedigree selected males for the improvement of groups of common breeds.

*Maine Experiment Station, Orono, Maine* 1) Inheritance of fecundity and selection for egg-laying. — 2) Mendelian inheritance of several plumage and other somatic characters. — 3) Inheritance of size of body and of size and colour of eggs. — 4) Interbreeding. — 5) Influence of exterior agents on germ plasma. — 6) Heredity and the determination of sex.

*Massachusetts Experiment Station, Amherst, Massachusetts*: 1) Selection for egg-laying. — 2) Study on the fertility of eggs from the genetic point of view. — 3) Inheritance of several exterior characters of poultry.

*Missouri Agricultural Experiment Station, Columbia, Missouri*: Study of sex-limited heredity: in the spotted plumage of the Hamburgh breed and of the plumage of cocks similar to that of the hens in the Sebright Bantam breed.

*New Jersey Experiment Station, New Brunswick, New Jersey*: 1) Inheritance of fecundity — 2) Heredity of several plumage and other somatic characters. — 3) Factor of barred plumage in White Leghorn with single comb. — 4) Heredity of colour of egg shells.

*North Carolina Experiment Station, West Raleigh, North Carolina*: 1) Heredity of high egg production. — 2) Heredity of colour of egg shell.

*Oregon Experiment Station Corvallis, Oregon*: 1) Heredity of high egg production. — 2) Correlation between type and high fecundity. — 3) Crossing. — 4) Development of a dual purpose breed (eggs and flesh).

*Utah Experiment Station, Logan, Utah*: 1) Study on the possibility of improving egg laying by uninterrupted selection. — 2) Study on egg-laying especially in connection with *a*) average winter production in comparison to average yearly production during the three first years of egg-laying; *b*) limits of seasonal variation in the average egg production of the group.

*Wisconsin Experiment Station, Madison, Wisconsin*: 1) Experiments on inbreeding. — 2) Study of the effects of lead-poisoning of males on their offspring. — 3) Heredity of plumage colour and other characters in pigeons. (*Ed.*).

eat production. The remedy for the former is sufficiently obvious and mple.

As regards the second factor the authors have shown in a previous aper (*U. S. Dept. of Agriculture Bulletin* 93, 1914) (1) that at hive tempeatures between about 57° and 69° F a normal broodless colony does not orm a cluster but the bees remain inactive in the combs. The formation f a cluster only takes place when the air immediately surrounding the bees alls to 57° F or lower. The bees in the centre then begin to generate heat y muscular activity, those at the periphery serving as insulators by crowdng together. The lower the temperature of the air around the cluster the reater the amount of heat the bees are required to generate, till finally point is reached when the amount of heat produced and muscular activity equired become excessive and the bees may die. Or the high temperature ay induce brood rearing, a phenomenon always dangerous to the survival of a hive. Further, the increased consumption of stores following increased activity results in an excessive accumulation of faeces within the ees, often culminating in dysentery.

In any locality in which the outer temperature falls to 40° F or below, winter insulation is therefore undoubtedly necessary.

The exact method of packing is not specially important provided nough insulation is given on all sides. A windbreak of evergreens is superior o a solid windbreak such as a house or solid fence. The best arrangement f hives is in groups of four, two facing east and two west, in this way they ay be left on the same stand throughout the year. The practice of leaving the front unprotected and faced to the south, in order to utilise the eat of the sun, is not to be recommended. An entrance 8 ins. wide by $^3/_8$ ns. high is ample.

The time of packing is also important, delayed packing may cause far ore damage than leaving the bees unpacked. Colonies which have wintered poorly need their insulation longest.

211 – **The Development of the Silk Glands in the Chief Races of Silk-Worms and their First-Crosses from the Point of View of the Quality and Length of the Reelable Silk from each Cocoon.** — Bucci, Pietro in *Le Stazioni sperimentali agrarie italiane*, Vol. XVLIII, Part 12, pp. 841-888. Modena 1915. SILKWORMS

The following breeds and hybrids have been investigated :

1) Native pure yellow.
2) White Japanese.
3) Green Japanese.
4) Pure Golden Yellow Chinese.
5) White Japanese female × native yellow male.
6) Yellow native female × white Japanese male.
7) Golden Yellow Chinese female × Yellow native male.
8) Yellow native female × golden yellow Chinese male.
9) Bivoltine breed :

(1) See *B.* Febr. 1915, No. 209. (*Ed.*).

The experiments were repeated during 2 years (1914-1915) the result of which lead to the following conclusions :

The weight of the adult worms in the above races is from 6000 to 8000 times that of the silk-worm at birth. In crosses between native and Japanese or Chinese breeds the adult worm is heavier when the native parent is a female than when it is a male.

The following measurements were made :

Weight of two silk glands, total length of each (reservoir , secretory and excretory duct) ; the average weight and total length of the worms. It was found that the heaviest silk-worms had also heavier silk producing apparatus and glands. In crosses between yellow native female and foreign male the average weight of the silk-producing apparatus and the glands was higher than in the reciprocal cross. The ratio between the weight of the worms and that of the silk producing apparatus is greatest (1 : 0.3082) in the Padua bivoltine breed, and least in the green Japanese breed (1 : 0.2004) whilst it is relatively high in the Chinese breed (1 : 0.2576) and higher in the crosses with the yellow native female than in the reciprocal crosses. This ratio varies from 20 to 30 per cent and averages 25 per cent.

In all the races studied the reservoir is always longer than the worm but in the golden yellow Chinese breed which has the greatest total length of gland the reservoir is shorter.

In the Japanese crosses there is little difference in the average length of each gland but with respect to the average length of reservoir the cross with a yellow native female appears to show a slight increase in the ratio between the average length of an adult worm and the average length of the reservoir.

In the cross double yellow × golden Chinese female and in the cross double yellow × yellow native female the above ratio is 1 : 4, so that the Chinese breed gives rise to a greater development in the mean total length of each gland. The average length of the secretory channel is greater when the cross is made with the golden Chinese female than with the yellow native female.

The ratio between the length of the reservoir and the total length of the cocoon of silk in each breed is a minimum in the green Japanese race (1 : 2591) followed by pure yellow native breed (1 : 2.666). It reaches a maximum in the pure golden yellow Chinese race (1 : 3.763) and is 1 : 3.069 in the bivoltine Padua race. It is higher in the crosses with a foreign female than in the reverse crosses and for both the foregoing it is higher than in the native yellow parent.

In determining in the different breeds the absolute and marketable weight of the empty cocoons and chrysalids it has been found that the yellow native race increases the weight of the chrysalids in the hybrids especially in the cross yellow native female × white Japanese male. The ratio between the chrysalid and the empty cocoon is generally greater in the crosses : yellow native breed × white Japanese than in the crosses of the same yellow native breed and the golden yellow Chinese breed. This ratio is higher in the bivoltine Padua breed and the green Japanese breed.

The average weight of the empty cocoon is a maximum in the yellow native breed and it is a minimum in the bivoltine race as in the white Japanese race. The same may be said of the weight of the chrysalis.

The average ratio per cent between the mean absolute weight of a normal cocoon and the mean absolute weight of the empty cocoon is a maximum in the yellow native race and in the golden yellow Chinese race. In the cross white Japanese female × yellow native male and that of the golden yellow Chinese female and yellow native male this ratio is higher than in the reciprocal crosses.

In the hybrids, the yellow native race increases the weight of the cocoon and of the chrysalid as well as that of the worms, especially at maturity.

It was found as was expected that the absolute weight of the reelable silk is greater in races with a greater absolute weight of empty cocoon, being a maximum in the yellow native race and a minimum in the bivoltine race.

In the white bivoltine race the mean ratio per cent between the mean absolute weight of a normal cocoon and the mean absolute weight of the reelable silk and also the ratio per cent between the mean absolute weight of the empty cocon and the mean absolute weight of the silk is very low, thus showing again how slight an advantage is obtained by rearing the bivoltine race.

In the yellow native race, the worms are heavier as also are their silk-producing apparatus, their empty cocoons and their reelable silk.

In the first cross white Japanese × native yellow female and in the first cross double yellow Chinese × native yellow female, the average weight of a worm, the average weight of the silk-producing apparatus, and the average weight of the empty cocoon and the average weight of the reelable silk are always higher than in the reciprocal crosses. Thus, this tendency to increase the weights of the worm, silk-producing apparatus, empty cocoon and reelable silk is a true dominant character transmitted always by the female with greater intensity than by the male.

There is a correlation between the average weight of the worm, the silk-producing apparatus and the silk cocoon, since the races with the least heavy worms (white and green Japanese and especially bivoltine) have also the lightest silk producing apparatus, empty cocoon and reelable silk.

The tendency to give a greater weight of silk is a dominant character of the native yellow race.

The lengths of the thread and the reelable silk of some races and hybrids are given in the following table :

The ratio between the average length of a worm at maturity and the total average length of cocoon is never less than 1 : 3 in the races studied. In the golden Chinese race it is even as high as 1 : 4. In the crosses the race with the highest ratio transmits this character to its offspring.

In each of the races studied the ratio between the average length of the reservoir and the average total length of a cocoon is always greater than 1 : 2.5. It reaches a maximum in the golden yellow Chinese race and is a minimum in the green Japanese and native yellow races.

## A. — *Total length of thread* (Mean values).

| | metres | | metres |
|---|---|---|---|
| Yellow Perugia | 807 | Shantung | 660 |
| Yellow Bione | 1050 | Corea | 650 |
| Yellow Montana | 920 | White bivoltine | 360 |
| Corea | 583 | Hybrid bivoltine female × Adrianopolis male | 683 |
| Yellow Persian | 850 | Hybrid bivoltine female × Cevennes male | 590 |
| Green Persian | 860 | Hybrid bivoltine female × Akazik male | 541 |
| Terni (1889) | 700 | | |
| Terni (1890) | 750 | | |
| Yellow Cyprus | 930 | | |
| Native yellow | 1090 | | |

## B. — *Average length of reelable silk.*

| | metres | | metres |
|---|---|---|---|
| Pure native yellow | 794 | Hybrid native yellow female × white Japanese male | 758.5 |
| White Japanese | 593.5 | Hybrid golden yellow Chinese female × native yellow male | 745.5 |
| Green Japanese | 515.5 | Hybrid native yellow female × golden yellow Chinese male | 541 |
| Golden Yellow Chinese | 655.5 | | |
| Bivoltine Padua | 749.5 | | |
| Hybrid white Japanese female × native yellow male | 739 | | |

## C. — *Physical properties of the reelable silk (two years' average).*

| Race of Hybrid | Mean weight of 450 metres in Italian denari (0.05 gms.) | Mean diameter of thread μ | Mean elasticity m. | Mean tenacity gms | Index (1) of threads tested in the serimeter. denari | Tenacity per denaro |
|---|---|---|---|---|---|---|
| Pure native yellow | 2.694 | 35.06 | 153.73 | 7.98 | 3.15 | 2.53 |
| White Japanese | 2.891 | 34.26 | 168.66 | 8.50 | 3.06 | 2.78 |
| Green Japanese | 2.936 | 32.33 | 148.81 | 7.29 | 2.76 | 2.63 |
| Golden yellow Chinese | 2.819 | 34.10 | 175.26 | 8.78 | 3.06 | 2.86 |
| Hybrid white Japanese ♀ × native yellow ♂ | 2.873 | 34.49 | 146.78 | 8.75 | 3.42 | 2.56 |
| Hybrid golden yellow Chinese ♀ × white Japanese ♂ | 3.222 | 35.83 | 157.29 | 8.12 | 3.06 | 2.64 |
| Hybrid golden yellow Chinese ♀ × native yellow ♂ | 2.785 | 33.78 | 165.01 | 8.26 | 3.30 | 2.49 |
| Hybrid native yellow ♀ × golden yellow Chinese ♂ | 2.887 | 34.38 | 169.88 | 9.07 | 3.30 | 2.76 |
| Padua bivoltine | 2.420 | 30.75 | 180.58 | 7.66 | 2.76 | 2.78 |

(1) The index number expresses the relationship between weight and length of thread and corresponds to the English "count number." The legal Italian standard is the weight of 450 metres expressed in Italian denari (0.05 gms.). (*Ed.*).

There is a correlation between the average weight of an adult silk-worm, the average length of the silk gland, the absolute weight of the reelable silk of a single gland and average length of the reelable silk. That is to say that the races with very long cocoons have also very heavy silk glands and a very long reelable silk, with consequently an average higher weight of reelable silk corresponding to one of the two glands of an adult worm.

The races showing these qualities transmit them to their first crosses but not to an equal extent, for the intensity with which the above qualities are transmitted in the hybrid differs appreciably according to the sex of this particular parent.

The physical properties of the reelable silk of normal cocoons of the races studied are given in table C.

212 - **Sericulture in Egypt.** — YACOB, GEORGES in *Bulletin de l'Union des Agriculteurs d'Egypte*, Year 13, No. 112, pp. 78-85. Cairo, October 1915.

The lack of exact statistics renders very difficult even an approximate calculation of the former importance of sericulture in Egypt, but the existence almost everywhere of old mulberry plantations gives some idea of the former prosperity of this industry. It is known also that Syria imported from Egypt considerable quantities of reproductive cocoons known as " Masri " which gave an Egyptian seed very much appreciated. The great development of cotton cultivation during recent decades has completely overshadowed silk-worm rearing and it is only the energetic initiative of particular individuals and the fortunate results of their experiments that have saved this industry and shown its possibility of again ocupying an important position in Egyptian agriculture.

The breeding experiments made on a large scale by MASRAFF at Ghizeh deserve special mention, especially for the undoubtedly superior quality of the cocoons obtained. The whites gave 1 kg of silk per 3200 gms of cocoons and the yellows 1 kg of silk per 3254 gms of cocoons.

At Ghizeh the mulberry plantations are increased each year and a model breeding station is now in course of construction which will be capable of providing instruction for a 1000 native families.

The abundance of cheap labour is one of the factors most favourable to the success of this industry.

Another factor of great importance is the increased production of mulberry leaves that can be obtained in the fertile irrigated Egyptian delta. The yield reaches from 223 cwt to 279 cwt per acre so that 1 *feddan* (about 1 acre) of mulberry trees is sufficient to rear 8 to 10 ounces of eggs and produce from 880 to 1100 lbs of cocoons. The cost of breeding is estimated at about £ 2 per ounce, leaving a net profit of £32 to £40 per feddan calculating on a selling price of 1s. 1d. per lb of cocoons.

In spite of these favourable conditions, however, State intervention is considered indispensable to obtain a greater development of silk-worm rearing.

With State assistance the following advantages may be secured:

1) the assurance to the *fellah* of good conditions for the sale of the product.

2) the free distribution of grafted mulberries to extend the plantations.

3) the free distribution during the first year of silkworm eggs.

4) the awarding of prizes to the best breeders.

5) the diffusion of theoretical and practical knowledge at the school of Agriculture, Ghizeh and at other practical schools.

Further advantages of this industry are :

1) the second crop of leaves could be used for fattening sheep as is done in Syria ;

2) it would supply a better fuel for domestic purposes than the cotton crop and help to remedy the lack of fuel which compels the *fellah* to use dry sheep dung for this purpose.

213 - **Experiments in Silkworm Rearing in Tripoli.** — *Bollettino di Informazioni del Ministero delle Colonie*, Year III, No. 8-9, pp. 518-522. Rome, September 1915.

In May 1915, the Agricultural Bureau of Tripoli began experiments on silkworm rearing with a view to testing the possibility of obtaining normal results in the region of the coastal oases in Tripoli. The mulberry trees growing in the gardens of the oasis are at present used chiefly as shade trees and more rarely as fruit trees. The experiments were carried under 4 conditions : *a*) in a locality situated near a garden of the oasis ; *b*) in a pit cut out in the ground with one side open and covered with a roof of palm leaves ; *c*) reared in the above pit until the last moult then transferred to the locality mentioned in (*a*) ; *d*) reared in a subterranean locality kept cool and well ventilated and situated in the buildings of the Sidi-Masri Institute in the open steppes.

The constant winds cause considerable injury to silk-worms reared in pits. The best results are obtained with silkworms removed from the pits before the last moult. The experiments under conditions *a* and *d* ran a normal course and gave good results, the former gave the highest yield and the latter the best cocoons.

The reed mats upon which the natives rear the worms do not appear very practical since they absorb too much moisture and soften easily. They require frequent changing and more open meshes to facilitate the circulation of the air. Several vegetable products were tried under pit conditions but all had more or less serious drawbacks. The question of the choice of materials remains for further study and the development of a reliable technique can only be attained by degrees. However, these experiments show that silk-worms can be reared in Tripoli with remunerative results.

The future activity of the Bureau of Agriculture will be directed along two lines : experimental researches on the best systems of rearing and the application of administrative measures towards encouraging the industry amongst agriculturists and natives, Samples of the cocoons were examined by Professor Verson at the Royal Sericultural Experiment Station at Padua. the results of which are summarised in special tables.

214 – **Examination of a Sample of White Oval Cocoons from Kiang-Sou, China.** — *Informazioni seriche*, Year II, No. 26, pp. 700-702. Rome, December 21, 1915.

The Silk Research Laboratory at Milan has examined a sample of several kilograms of Kiang-Sou Cocoons of an elongated oval shape and golden in colour obtained last spring from a batch of industrial Chinese eggs reared at the Royal Sericultural Observatory at Ivry.

After separating the really white cocoons (90.95 per cent) from the waste (5.02 per cent), the various shades of yellow (0.82 per cent) and the doubles (3.21 per cent) they were tested for the following characters: average weight of cocoon, size, ratio between cocoon and chrysalid, length and weight per unit length of reelable silk, industrial selection of cocoons, weight per unit length of silk thread, dynamometric tests, loss on washing and removal of gum.

The cocoons examined showed the most appreciated qualities and included some of the most regular with regard to the yield of silk, shape and dimensions of cocoons, etc.

As was formerly observed in previous studies of other important varieties of Chinese silk (Voozia, Shaoshing, Dong-Ding, Sagnew), the percentage ratio between the cocoon and chrysalid was fairly high, however, the easy reeling (little beating being required to obtain a good thread) and the complete utilisation of the cocoon, reduces the proportion of waste to a minimum, with a considerable increase in the yield of raw silk.

The raw-silk of Kiang-Sou cocoons leaves nothing to be desired with regard to uniformity of colour, gloss consistence, etc. The exceptionally easy reeling of the thread enables a raw silk to be obtained by selection under industrial conditions, of a remarkable regularity and evenness of thread. Examination on the black table shows that the number of faults occurring even in the most valuable silks (curling and matting together of the fibre) was very limited.

The weight per unit length ("titolo") of the raw silk was very regular, and in 30 control reeling tests the variations did not exceed 3 deniers (1 denier = 0.05 gr.) on an average titolo of 13.3. As in the case of the other Chinese white cocoon races examined the proportion of sericine was very low, not exceeding 16.4 per cent.

215 – **Canadian Musk Rat (*Fiber zibethicus*) Injurious to Fish in Austria.** — HERALEK, J., in *Oesterreichische Forst-und Jagd Zeitung*, Year 33, No. 51, p. 335 Vienna, December 17, 1915. FISH

Several methods of destroying the musk rat in fish-ponds in Austria have been tried but without practical results up to the present. Researches are in progress with a view to their destruction by means of bacteria (1).

An apparatus for trapping this pest has recently been invented by PHOTSKY, an Imperial Forester, and promising results have been obtained, hundreds of animals having been captured in a single summer.

(1) See *B.* April 1915, No. 417, also *B.* Feb. 1915 No. 242. (*Ed.*).

The apparatus (which is minutely described and illustrated by the writer) is placed at the exits of water courses, in open ponds, etc., and once the animals enter they are unable to escape and may be easily caught. The size and shape of the apparatus varies according to the position in which it is intended to be fitted and its price varies from 8*s.* to £1.

## FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

216 – **New Plans of U. S. Department of Agriculture Concerning Farm Machinery and Implements.** — FAWCETT, WALDON, in *Farm Implement News*, Vol. XXXVI, No. 39, pp. 16-17. Chicago, September 30, 1915.

With the object of inducing more and better farming, the U.S. Department of Agriculture in its programme for next year has included a certain amount of work on farm equipment.

The Office of Farm Management will prosecute investigations in farm management and farm practice, it will spend about $ 10 000 in a specific study of farm equipment and four experts will devote the whole of their time to this work, which is to " determine the character, cost and adequacy of machinery on farms of different types and sizes in different parts of the country ". The plan of action will be to collect at first hand masses of data dealing with the experience of farmers in regard to the various standard items of farm equipment and then draw conclusions from the study of these field reports.

Among the subjects to be investigated are: light tractors, the character and cost of the various types of farm fences, green house equipment, including heating systems, the machinery and implements best suited to the cut-over lands of Michigan, Wisconsin and Minnesota, the means and methods needed for farming the swamp lands of the north central States, the corn belt States and the sandy lands. Especially important will be the investigations on incubators with the object of increasing their efficiency. A sum of $ 1000 is set aside for the examination of the relative efficiency of the many types of spraying apparatus now on the market in order to determine the most economical types for given kinds of work.

The Office of Grain Standardization will pursue investigations with a view to determining to what extent the commercial value of grain is affected by present methods and machinery used in harvesting and handling the grain.

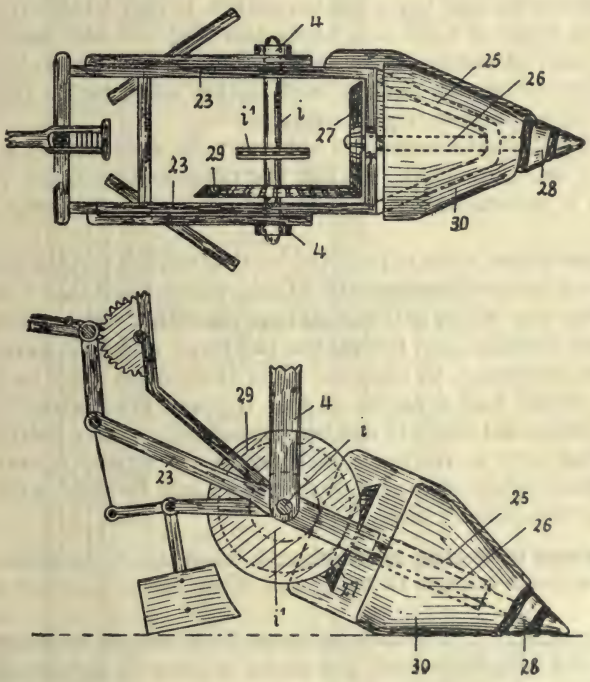
Another new investigation on the part of the Government is one designed to bring within reach of farmers effective waterproof and mildew proof fabrics for use as wagon covers, stack covers and the like. The examination into the causes of thresher explosions and fires is also to be extended, as last year more than one million dollars' worth of farm machinery were destroyed in the Pacific north west from this cause (1).

(1) See *B.* May 1915, No. 536. (*Ed.*).

A reorganized division of the agricultural department is the Office of Public Roads and Rural Engineering. It will deal with the whole subject of road machinery and include a continuation of traction tests, and it will consider such factors as width of diameter of wheel, type of axle bearing, etc. of farm wagons. The same Office will concern itself with the subjects of water supply on the farms, farm drainage, the construction of farm buildings, gasoline engines, the durability of the materials used in sprayers, pumps for wells, and for irrigation, while yet another office, that of Irrigation Investigations will prepare a report upon subirrigation and watering by spray systems.

217 – **Screw Furrow Opener.** — *Maschinen Zeitung*, No. 24, pp. 98-99, Berlin, December 15, 1915.

This furrow opener constructed by BRUNO HERN of Dohma, Saxony, and patented in Germany under No. 288 883 is an attachment for potato




Screw Furrow Opener.

planters and the like. Its chief features are: a screw which bores into the ground and a conical case placed behind the screw which gives the furrow a uniform breadth and stiffens its sides that otherwise might easily cave in.

Fig. 1 shows the plan and fig. 2 the side view of the machine. Two

arms 4 are fixed to the usual frame of the planter, they bear a shaft *i* on which a chain sprocket $i_1$ and a bevel gear 29 are mounted.

The shaft bears also a frame 23, the front of which is traversed by a shaft 26 carrying, at one end, a bevel gear 27 which gears permanently at right angles with wheel 29; while the other extremity passes through the support 25 fixed to the front of the frame and ends in the screw 28 which bores into the soil. Behind the screw the sheet iron casing 30 which forms the furrow is situated.

When the machine is drawn forwards the borer is caused ro revolve by a chain, not shown in the figure, on the sprocket $i_1$ which drives the shaft *i*, and, by means of the bevel gears 27 and 29, the shaft 26. As the frame 23 can rotate on the shaft *i* the inclination of the furrow opener can be adjusted as required.

218 – **Self-lighting Attachment for Smudge Pots.** — Byers, Charles Alma, in *The Scientific American*, Vol. CXIII, No. 21, p. 445. New York, November 20, 1915.

It is estimated that there are between 2 ½ and 3 million smudge pots in use in the State of California alone and they are also used extensively in Florida and to some extent in Colorado and other States (1). They serve to protect orchards against frost as they can raise the temperature of an orchard by approximately 10 degrees.

A self-lighting attachment of smudge pots, operated by a thermostat, has recently been invented. When the temperature sinks to a certain point a fire is automatically started and the pot procceeds to perform its duty.

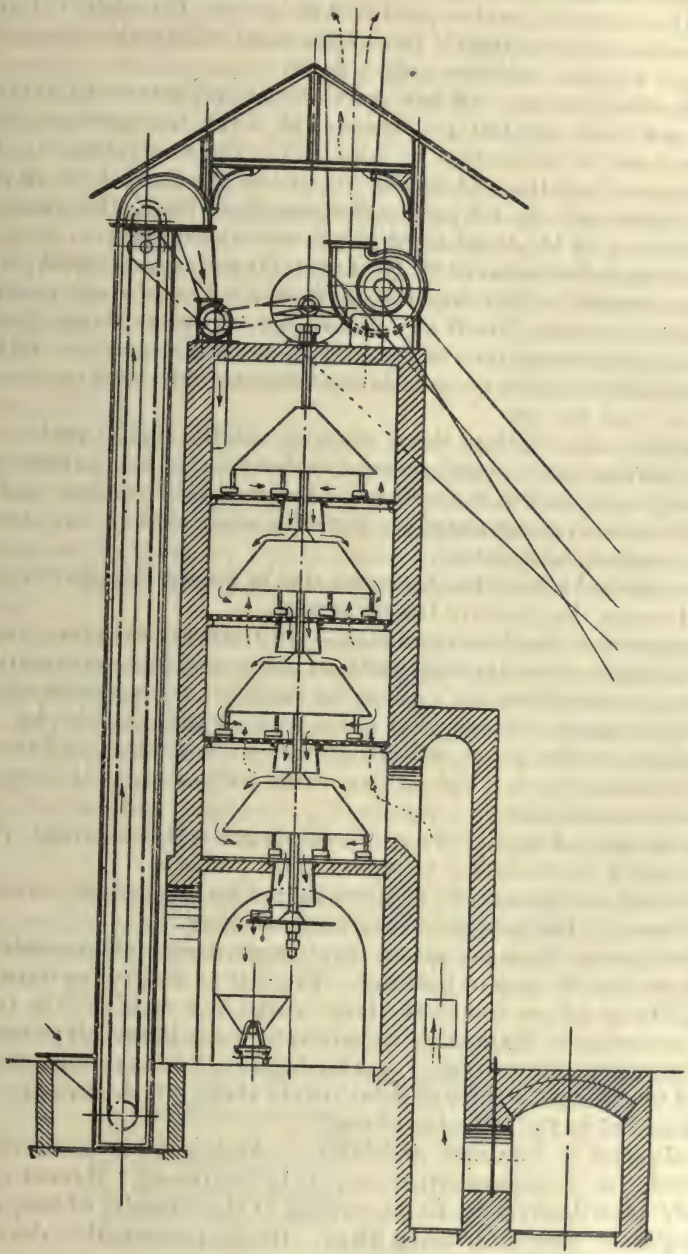
This thermostat when contracted by the cold to a certain predetermined degree of temperature releases a cup of acid, which spills into a compartment of the smudge pot where it comes in contact with a combustible saturated with another chemical and fire is thus produced which, in turn, ignites the crude oil or petroleum, in the pot. The thermostat may be regulated to operate to within half a degree of any temperature desired and the construction is such that the acid can be released only by the thermostat. The pots are constantly in readiness and require no attention until after they have been fired when, of course, they must again be filled with oil and the self-lighting attachment reset.

219 – **Agricultural Desiccating Installations.** — Malpeaux, L. (Director of the School of Agriculture, Pas-de-Calais) in *La Vie Agricole* Year 6, No. 1, pp. 1-8. Paris, January, 1, 1916.

Several agricultural industries leave by-products such as pulps, brewers' grains and the like which are useful as food for live stock but which, for their low keeping qualities, high water content, and for the fact that they are produced in large quantities during short periods, must be rapidly consumed and within a short distance of the place where they are produced.

In order to remedy these difficulties and to avoid the losses caused by ensilage, which are sometimes as high as 30 per cent, desiccation has been

(1) See also *B.* Jan. 1916, No. 5. (*Ed.*).



HUILLARD'S desiccator.

resorted to. At first it was limited to beetroot pulps but it has since been extended to beetroots, potatoes, and brewers' grains. Especially in Germany desiccation is much practised. Out of 360 sugar mills no less than 160 dry their pulps, whereas in France only 3 do so.

*Desiccation of beets.* — Of late years several desiccators on LAFEUILLES' system have been installed in France, but while they produce excellent wares their cost of production is too high. The desiccation of 1 ton of beets costs not less than 9*s* 8*d* per ton and at the price of 20*s* 2*d* per ton for sugar beets and 14*s* 6*d* per ton for semi-sugar beets, the prices of the dried slices are 6*s* $6^{3}/_{4}d$ and 6*s* $5^{3}/_{4}d$ per cwt. respectively.

The French desiccator of M. HUILLARD (1) with cone-shaped divisions, fig. 1, has attained a high degree of perfection. One of them installed at Coudekerque-Branche (Nord) at a cost of £ 7 000 treats about 60 tons of beets containing 82 per cent of water in 24 hours and produces 12 tons of dried slices containing 10 per cent of moisture at a cost, with coals at 20 *s* a ton, of 1*s* $7\frac{1}{4}d$ per cwt.

The food value of these dried slices approaches that of grains. They contain however less protein and more carbohydrates, for the most part in the form of sugar, and they can be fed advantageously to horses and milch cows, but are not recommended for fattening stock as they cost as much as cake and contain less protein.

The tops and tails of the beets can also be passed through the desiccator and increase the profits of the sugar mills.

*Desiccation of beet leaves and tops.* — In Germany for some years past several installations for the drying of beet leaves and tops have worked, for the most part with BÜTTNER'S process, by means of an apparatus consisting of three gratings placed over each other with an automatic loader. For 1 cwt. of dried product 4 or 5 cwt. of fresh leaves are required, and the cost of drying is from $9\frac{1}{4}d$ to $9\frac{1}{2}d$ per cwt. while its food value is about 1*s* per cwt. but it is sold dearer.

The leaves and tops produced by an acre of beets are about 9 ½ tons per acre which yield about 1 ½ tons of dried produce.

*Desiccation of potatoes.* — Potatoes cannot be dried whole because they become horny in the process. They must be sliced.

There are in Germany about 250 potato drying plants which treat yearly 7 to 800 000 tons of potatoes. The cost of desiccating ranges from 2*s* $10^{3}/_{4}d$ to 4*s* 9*d* per ton in the large works and 7*s* 3*d* to 8*s* in the small ones. According to KELLNER'S experiments, made in several parts of Germany, one third of the ration of oats for horses can be very advantageously replaced by an equal weight of dried potato slices, which have also proved very successful in the fattening of pigs.

*Desiccation of Jerusalem artichokes.* — Among the crops which can be desiccated, the Jerusalem artichoke is to be mentioned. It is not esteemed as highly as it deserves to be, on account of the difficulty of keeping it for any length of time after being lifted. By desiccation this drawback is

(1) See also *B.* Aug. 1913, No. 974. (*Ed*).

eliminated, and the dried slices keep well especially if compressed under the form of cake.

Jerusalem artichokes can be dried in HUILLARD'S apparatus. Their water content, which is about 80 per cent, is reduced to 15. The cost of drying is about 1*s* 5*d* per cwt. of dried product, the total cost of which, with fresh artichokes at 11*s* 3*d* per cwt. is 3*s* 6*d* per cwt. while its food value is at least 5*s* 3*d* to 5*s* 7*d* per cwt.

*Desiccation of other by-products.* — Pulps, brewer's grains and pomaces when dried can be easily transported, stored and used. In order to realize the greatest economy they must of course be desiccated in the works where they are produced and, as far as possible, by means of the waste heat.

Among the French desiccators the writer mentions DONARD'S vacuum drier used especially for the by-products of the distilleries of amylaceous substances, and HUILLARD'S desiccator, which is simple and strong, it works with great regularity, dries evenly and has been used in a number of different industries.

It consists essentially (see fig.) of a round masonry tower divided into three or four stories by perforated cast iron floors. The stuff to be dried passes automatically and continuously on to each of these floors in succession in a layer of uniform depth. The gases are drawn in hot and dry at the bottom of the tower, by a special ventilator which forces them through the several floors and finally expels them, quite cool and laden with moisture, at the top.

The machinery consists chiefly of a central vertical shaft suspended on ball bearing carrying three or four truncated cones, to each of which shovels are attached. The object of these is to move the stuff towards the centre of each floor whence it falls through an aperture and a kind of funnel on the truncated cone below. The mass of stuff between the funnel and the revolving cone obliges the hot air to pass through the perforated floors thus utilizing the heat most efficiently. The heating can be effected either by a special heater or more economically by using the waste heat from other plant.

Besides the desiccator above described M. HUILLARD has devised smaller ones on the same principle for farms and industries on a small scale. "The Omnium" desiccator is only 5 ft 10 in. in height and 36 inches in inner diameter.

220 – **Review of Patents.**

*Tillage machines and implements.*

| | |
|---|---|
| Canada | 164 078. Ditching machine. |
| | 164 306 — 164 366. Ploughs. |
| | 164 269. Farm implement. |
| Denmark | 20 692. Ditching machine. |
| | 20 764. Furrow cleaner. |
| | 20 789. Cultivator. |
| Sweden | 39 070. Harrow tine. |
| | 39 100. Rotary tilling machine. |

39 101. Device for motor ploughs.
39 223. Plough beam.
United Kingdom 17 238. Motor driven cultivating machine.
United States 1 159 680. Tractor for ploughs.
1 158 906. Combined cultivator and weed cutter.
1 158 838 — 1 158 936 — 1 160 025. Ploughs.
1 159 063. Mouldboard for ploughs.
1 159 115. Furrow opener attachment.
1 159 268. Automatic disengaging motor plough.
1 159 568. Weed cutting cultivator.
1 159 689. Wheeled plough.
1 159 965. Motor propelled tillage machinery.
1 160 027. Cultivator shovel.

*Manure distributors.*

Sweden 39 149. Fertilizer spreading machine.
39 193. Adjustable feed for fertilizer spreading machine.
United Kingdom 17 390. Sprayers or spreaders for thick, muddy or manure waters.
United States 1 158 700. Fertilizer distributor.

*Drills and sowing machines.*

Sweden 39 069. Drill.
39 192. Device for sowing machines.
39 226. Device for potato planters.
United Kingdom 17 757. Potato and like planters.
United States 1 158 847. Corn planter.
1 159 443. Corn planter driving mechanism.

*Reapers, mowers and other harvesting machines.*

Denmark 20 677. Cutter bar for mowers.
20 684. Device for collecting grain in harvesters.
20 772. Device for reapers.
Switzerland 71 422. Sheaf binder.
71 423. Hay harvesting machine.
Sweden 39 006. Horserake.
39 150. Fastening for scythe handles.
39 194. Hay rake and carrier.
39 224. Gin for hay elevators and the like.
39 300. Fastening for tines of horse rakes.
United Kingdom 17 159. Lawn mowers.
United States 1 158 445. Harvester.
1 158 470. — 1 159 370 — 1 159 548. Corn harvesters.
1 158 500. Cutting apparatus for mowing and reaping machines.
1 158 536. Hay loader.
1 159 444. Hay rake and tedder.
1 159 574. Grain shocking machine.
1 159 887 — 1 159 888. Grain harvesters.
1 159 987. Tractor binder hitch.
1 159 988. Tandem draught connection for harvesters.

*Machines for lifting root crops.*

| | | |
|---|---|---|
| Denmark | 20 654. | Root lifting machine. |
| | 20 727. | Machine for lifting and topping root crops. |
| | 20 734. | Apparatus for cleaning and carrying root crops. |
| | 20 759. | Potato digger. |
| United States | 1 158 956. | Beet harvester. |
| | 1 159 110. | Wheeled potato digger. |

*Threshing and winnowing machines.*

| | | |
|---|---|---|
| Italy | 149 568. | Self feeder for threshing machines. |
| United States | 1 158 944. | Threshing machine. |
| | 1 160 088. | Feeding mechanisms for corn huskers. |

*Machines and implements for the preparation and storage of grain, fodder, etc.*

| | | |
|---|---|---|
| Canada | 164 675. | Silo. |
| Denmark | 20 685. | Straw press. |
| Italy | 141 220. | Automatic needle for hay and straw presses and the like. |
| Sweden | 39 007. | Shovel for riddling potatoes. |
| United States | 1 159 388. | Overhead hay carrier. |
| | 1 159 935. | Feed cutter. |
| | 1 159 948. | Hay press. |

*Dairying machines and implements.*

| | | |
|---|---|---|
| Sweden | 39 068. | Hygienic milk-can. |
| | 39 301. | Device for pulsating milking machine. |
| United Kingdom | 17 738 — 17 739 — 17 740. | Cow milkers. |

*Other agricultural machines and implements.*

| | | |
|---|---|---|
| Canada | 164 308. | Animal trap. |
| Italy | 150 128. | System of ventilation especially applicable to esiccators for macaroni. |
| Switzerland | 71 289. | Watering installation with troughs filling automatically. |
| | 71 425. | System of silkworm nursery for warm countries with the object of keeping a suitable temperature for silkworms. |
| Sweden | 39 148. | Machine for making covered drains. |
| | 39 267. | Tree felling and sawing machine. |
| United Kingdom | 17 265. | Appliance for extracting nicotine from tobacco by reduced pressure. |
| | 17 363. | Machine for preparing fibres for spinning. |
| | 17 488. | Incubators. |
| | 18 050. | Machine for depericarping fruit. |
| | 18 134. | Ring for pigs. |
| | 18 231. | Packing device for eggs. |
| United States | 1 159 163. | Tractor chain (endless track). |
| | 1 159 223. | Tractor. |

## RURAL ECONOMICS.

221 – **Influence of the Size of the Farm upon the Wages of Labour in the Irrigated Sections of the United States.** — SPILLMAN, W. J. Farm Management Surveys on Irrigation Projects, in the *Country Gentleman*, Vol. LXXX, No. 49, pp. 1832. Philadelphia, December 4, 1915.

The Federal Office of Farm Management has made surveys of the farming business (1) in many of the irrigated sections of the United States, particularly in Utah and Arizona. In several farms, grouped according to size, the wage made by the owners of the farms and their families were calculated. It was found that in thirty-five small farms where the farming was just as intensive as market conditions permitted, with an average crop area of 16 ½ acres, the average wage made by the owners was $247, just a little more than half of local farm wages.

Two types of farming in Utah were quite successful when the size of the farm was sufficient :

1. — Farms of about 40 acres in which 5 to 7 acres were devoted to sugar beets. The yield of this crop was, in these farms, much above the average for the country, while the price was approximately the same. The best economical results were obtained when the sugar beet business was conducted mainly by the members of the family, and when it was combined with dairying or poultry-keeping or both. Farms smaller than this were generally not successful.

2. — Farms of 80 acres or more under general farming, including production of grain and livestock.

The conclusion drawn was that with sugar beets the forty-acre farm in that region was feasible, without the sugar beets eighty acres should be the minimum size of the farm. With lands at a reasonable price this area should be successful on the basis of dairying, beef cattle, grains and family sized patches of sugar beets.

During the last two years Prof. R. W. Clothier of the Farm Management Office has made a detailed analysis of the business of 543 farms under irrigation projects in Arizona. Forty of these farms were less than 15 acres in area, averaging about 10 acres. The average wage made by the owners was $235.

The 20-acre group contained 63 farms; the average wage made by the owners was $265. The 30-acre group contained 43 farms, whose owners made wages averaging $256.

Thus 146 of these 543 farms were so small that their owners made wages just about half those that a good farm labourer can command in that region. These farms are too small for satisfactory results. The land is also too high priced, the average for these groups of farms being nearly $500 an acre.

The 40-acre group of farms contained 86 farms, whose owners made

(1) See No. 216 above.

wages of $434. The 60-acre group made wages of $458. It is only in the 80-acre group which contains 97 farms that the owners make wages equal to those of a good farm labourer : $580.

On the other hand there were 44 farms in the survey averaging 375 acres, whose owners made enough to pay 8 per cent on their investments and have left an average salary of $2288. A few of the small farms did very well but they were not fruit and vegetable farms, but mainly poultry and dairy concerns. The poultry was more prominent on the small farms and dairy cows on the larger ones.

The close agreement in the case of the Utah and Arizona surveys with similar studies in all parts of the Eastern half of the United States justifies the conclusion that farms of less than 40 acres are not advisable on any of the irrigation projects and that in irrigation enterprises 80 acres should be made the minimum size of farm.

If farming is to be as productive as other lines of business, the writer believes that 500 acres is not too large a limit to set upon the area which a single individual is permitted to own under an irrigation project.

222 – **Regulation of the Association of Spanish Agriculturists for the Purchase, Sale and Leasing of Farms.** — *Boletín de la Asociación de Agricultura de España*, No. 78, pp. 290-291. Madrid, November 1915.

Considering the difficulties attendant upon the investment of capital in farming, considering also the want of an institution capable of supplying reliable economic and analytical data on farms in the market, the Association of Spanish Agriculturists has founded a business office (Centro de contratación) for the use of its members and subject to the following regulations :

*Special regulations for the purchase, sale and leasing of farms.*

Art. I. — The Association of Spanish Agriculturists institutes a special service for the purchase, sale and leasing of farms, for the exclusive benefit of the members of the said Association and of the associations which belong to it as collective members.

Art. II. — The Association will present a detailed list of the farms to be sold or leased accompanied by photographs and other documents which may be necessary. It guarantees the trustworthiness of the data which accompany the offers, under the responsibility of the technical Professor of the Association.

Art. III. — The Association will keep two registers : One containing the offers of farms for sale or lease, the other the requirements of intending purchasers . In order to be inscribed in the first register, the applicant must belong to the Association or to one of the Associations belonging collectively to the Association ; he must pay the fixed subscription of 100 pesetas (about £4) to cover travelling and other expenses of the technical Professor such as his visit to the farm on sale, its identification, the photographs, checking the data supplied etc. The applicant must also present a request for the above control, together with an engagement to facilitate it.

The inscription in the requirements register takes place at the request of a member.

Art. IV. — The technical Professor of the Association guarantees, by his signature, the accuracy of the data supplied as to the quality of the soil, the class of crops, the means of communication, the buildings, stock etc.; but not the acreage except when there exist plans proving the extent of the farm. The valuation of the farms is left exclusively to the vendor.

Art. V. — When the sale or lease has been effected, the contracting parties have no fee of any kind to pay, as the services of the Association are gratuitous.

Art. VI. — Both offers and demands will be published in the Bulletin of the Association for the information of all its membrs.

Art. VII. — Any doubt or unforeseen difficulty which might arise in the application of this Regulation will be settled by the board of the Association.

223 - **Labour Cost of Producing Maize in Ohio.** — GODDARD, L. H. and ELSER, W. L. in *Bulletin of the Ohio Agricultural Experiment Station*, No. 266, pp. 85-124. Wooster, Ohio, December 1915.

The cost of labour in producing maize in Ohio is the largest single item in the total cost.

The data given in this report were obtained from farms situated in various parts of the State comprising 200 fields with a total area of more than 2000 acres.

The total labour required averages 48.18 man hours and 55.44 horse hours; and at 16 cents (8 *d.*) per man hour and 8 cents (4 *d.*) per horse hour the total cost per acre is $12.14 (£2-9-0), varying from $ 9.62 in the Southwest to $ 12.46 in the Northwest, $ 16.28 in the Northeast and $ 16.76 in the Southeast. The cost of labour in 34 municipalities averages 19 cents (9 ½ *d*) for common labourer and 44 cents (1/10) for labourers with team.

In many cases the crop yield per acre is not sufficient to pay for the single item of labour required to produce it, unless the labour is paid at an extremely low rate. Within certain limits the labour cost per acre is less on large fields than on small ones.

The cost of replanting, which is still a common custom, is more than that of the first planting by machine. It would seem that a considerable amount of the hand labour especially in cultivating could be replaced by machine work. The cost of harvesting is more than one third of the total labour cost, so that a great saving is effected by grazing the crop.

224 - **Economics of Apple Orcharding in the Pacific Northwest.** — LEWIS, C. I. and VICKERS H. A. in *Oregon Agricultural College Experiment Station, Bulletin* No. 132, 104 pp. Corvallis, Oregon, June 1915.

For the past four years the Division of Horticulture of the Oregon Agricultural College Experiment Station has been conducting investigations dealing with the cost of fruit production in the Pacific North-West, which have entailed the study of a thousand orchards situated in the States of Oregon, Washington, Idaho and the Province of British Columbia.

All figures are taken from farms which have at least two-thirds of their entire acreage devoted to orchard and at least two-thirds of this orchard devoted to apples.

In the first part of the Bulletin the writers have collected in numerous tables the results of their calculations on the costs of production of apples, dividing the expenses under four principal heads, namely growing costs, handling costs, overhead costs (interest, taxes, depreciation), storage and sale costs.

Of these results the most important are given here.

The cost of starting an orchard, that is clearing the land and planting the young trees, averages in the Pacific North-west $ 112.82. This amount of course varies considerably according to type of soil, labour conditions etc. The cost of clearing may range from $ 50 to $ 200 per acre.

The costs of maintenance and development of the young orchard are as follows :

| | | | |
|---|---|---|---|
| Orchards with trees 1 to 3 years old . . . . . | $ | 62.72 | per acre |
| » » » 4 to 5 » » . . . . . | » | 60.36 | » » |
| » » » 6 to 7 » » . . . . . | » | 52.87 | » » |

If the farms be divided into groups according to the number of horses kept upon them, namely 2,3 or 4, the results set forth in table I are obtained,

TABLE I. — *Cost of production according to horse units.*

| | Class 1 | Class 2 | Class 3 |
|---|---|---|---|
| Number of horses . . . . . | 2 | 3 | 4 |
| Average size of orchard, acres . . . . . | 20 | 25 | 30 |
| Average cost of production, $ per acre . . | 38.23 | 40.15 | 42.62 |
| » » of overhead charges. . . . . | 37.82 | 52.24 | 37.22 |
| » » of handling crop . . . . . | 49.05 | 55.61 | 76.14 |
| » » of selling, warehouse and storage . . . . . | 27.39 | 30.20 | 40.92 |
| Total . . . | 152.49 | 178.20 | 196.90 |

From these results the writers draw the conclusion that there are too many horses used in all average orchards.

In another series of tables the orchards are classed according to acreage and to the age of the trees and the costs of production are given for each group per acre and per bushel box of apples.

The cost of production, in general, diminishes as the size of the orchard increases. The exception to this rule are due to the fact that for each locality there is an optimum limit set by the natural and economical conditions of the region and that the costs of production are lowest where the extent of the orchard approaches more closely to this optimum limit.

The writers discuss next, always from the economic point of view, the following questions : choice of variety ; method of judging the production

TABLE II. — *The cost of Production of Apples.*

| Orchards 6 to 9 years | Av. yield per acre, bushels | Per Acreage | | | | Per Box | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Maintenance | Overhead | Handling | Total average | Maintenance | Overhead | Handling | Total average |
| | | $ per acre | $ per acre | $ per acre | $ per acre | $ per box | $ per box | $ per box | $ per box |
| Class I under 11 acres . | 150 | 40.85 | 74.18 | 71.09 | 186.12 | 0.2723 | 0.4941 | 0.4739 | 1.2403 |
| » II: 12 to 25 acres. | 158 | 35.93 | 71.50 | 64.97 | 172.40 | 0.2211 | 0.4525 | 0.4112 | 1.0848 |
| » III: 26 to 50 » | 95 | 26.90 | 43.43 | 38.85 | 109.18 | 0.2832 | 0.4572 | 0.4089 | 1.1493 |
| » IV: over 50 » | 77 | 19.16 | 39.01 | 37.82 | 95.99 | 0.2488 | 0.5066 | 0.4912 | 1.2466 |
| Total, orchard 6 to 9 years average. . . . . | 120 | 30.71 | 57.03 | 53.18 | 140.92 | 0.2564 | 0.4776 | 0.4463 | 1.1803 |
| Orchards 10 to 18 years: | | | | | | | | | |
| Class I. . . . . | 225 | 52.03 | 109.69 | 95.34 | 257.06 | 0.2312 | 0.4875 | 0.4235 | 1.1422 |
| Class II . . . . . | 286 | 38.46 | 137.33 | 59.32 | 235.11 | 0.1344 | 0.4802 | 0.2074 | 0.8220 |
| Class III. . . . . | 188 | 31.77 | 85.26 | 52.31 | 169.34 | 0.1689 | 0.4535 | 0.2782 | 0.9006 |
| Total orchards 10 to 18 . | 233 | 40.75 | 110.76 | 68.99 | 220.50 | 0.1782 | 0.4737 | 0.3030 | 0.9549 |
| Total orchards 6 to 18 years average . . . . | 176.5 | 35.73 | 83.90 | 61.09 | 180.72 | 0.2173 | 0.4757 | 0.3747 | 1.0677 |

of the orchard; treatment of the trees; intercropping with vegetables, small fruit etc.; pasturing pigs, dairying (experiments drawn from actual practice) and poultry keeping in connection with orchards; laying out, tillage, pruning, fertilizing, spraying etc.; marketing of produce, establishment of a Bureau of Statistics and of a fruit grower's Protective League; utilization of low grade apples.

The second part of the Bulletin contains some complete and detailed reports furnished by orchardists on the cost of production and on the economic results of a certain number of orchards under various climatic, soil and topographic conditions.

225 – **The Problem of the Sale of Agricultural Products in the United States in Connection with Economy in Farming.** — CARVER, T. N. in *Proceedings of Farmer's National Congress of the United States, Thirty-Fourth Annual Session,* Port Worth, Texas, 1914, pp. 71-91. Kendalia, W. Va., June 30, 1915.

In a communication made to the 34th National Congress of the farmers of the United States, the writer first drew attention to the fact that the problem of increasing the supply of agricultural products in the country is dependent upon the inducement in the way of profit that the farmer has for enlarging his enterprise, and that with the intensification, or extension, of cultivation, this profit can only be obtained by increasing the price of the products, or decreasing the cost of the methods of production employed. The writer then explained the economic problem of the sale of agricultural products and the purchase of the raw materials necessary to agriculture.

Under the conditions at present obtaining in the United States, the great object is to produce for farmers one of the best means of increasing or decreasing respectively the price of the products sold and the cost of those purchased. The writer remarks in this connection that, the productive unit to which American agriculture is always inclining in its attempts to determine what sized farm has the greatest productive power, is the small farm which will occupy the full working time of an average farm family when equipped with the best tools and team force. In horticulture this will mean a farm of 10 acres; in general hay and grain farming, a farm of about 160 acres; in pasturage it will take a larger number of acres. In the grain and live-stock region 40 and 80 acres farms and the big bonanza farms are tending to disappear, while the concentration of such farming is taking place on farms of from 160 to 200 acres. The small farm possesses, from a certain standpoint, the greatest productive capacity, as the farmers family itself is the working unit, and this obliges the owners of larger farms to sell out, but on the other hand this type of farm is rather inefficient in bargaining power; here is where cooperation comes in, a large number of highly efficient, producing units unite to form a larger and more efficient bargaining unit.

This last fact exercices considerable influence upon all farming economy, for the different degree of difficulty presented by the sale of various agricultural products in proportion to the area that can be used for their cultivation in the above-mentioned small farms, leads to important consequences; the abandonment of all agricultural specialities, the sale of which requires more efficient bargaining capacity and a more complete commercial organisation; and the cultivation of staple crops that are less difficult to sell.

This tendency towards the cultivation of staple crops on the small farm, is in direct contradiction to what ought logically to be practised, viz the growing of special crops which can make better use of its more intense productive capacity. One symptom of this tendency which is due to the effect of other more important economic factors, is the gradual migration of the wheat belt towards the virgin soil. The centre of winter wheat production is now in Kansas and the centre of spring wheat production in the Dakotas, but this migration will probably continue until most of the spring wheat is produced beyond the Canadian border. The same tendency has shown itself in the westward migration of the cattle producing area. All this shows the necessity for small farmers of : 1) growing higher-priced products which will be the more difficult to sell the smaller the quantity put on the market ; 2) cooperating, so as to oppose the capitalist farmer by means of a commercial organisation which they did not individually possess.

The phenomenon of monoculture in the cotton zone is, according to the writer, caused by the difficulties which the farmer has hitherto encountered in the sale of the other crops he could produce. This uncertainty and this aversion to new crops will doubtles continue until the farmer has

recourse to cooperative organisations which will supply him with the means of conquering the markets.

The writer then deals with the importance of an organisation for the purpose of obtaining the principal means of production: capital, of which the importance is continually increasing, seeing that American agriculture is based on economy of labour; he further remarks that if the problem is not solved, especially as regards those farmers not yet possessing the capital necessary for agricultural undertakings in America, farming in that country will be beyond the means of any but capitalists.

In conclusion, Dr Carver speaks of the disastrous effect of absentism upon the development of rural communities, and once more extols agricultural organisation in all its forms, as the means of preventing the modern forms of social economy from depriving rural communities (as history proves they would logically do), of all that serves to beautify, adorn, and render dignified the life of the tiller of the soil.

226 – **A Critical Study of the Methods of Valuation.** — CHIERICI, REMO, in *Annali della Società degli Ingegneri e degli Architetti Italiani*, Year XXX, Part 16, pp. 302-304; Part 17, pp. 305-310; Part 20, pp. 329-334; Part 21, pp. 342-345; Part 23. pp. 361-362. Rome, August-December 1915.

The criticism made by Prof. Aereboe (1) of the two analytic methods of valuing land, the one based on the returns, and the other upon the capital value, and his proposal that recourse should be had to the statistical system, have given an opportunity for renewed discussions between the partisans of the synthetic-comparative (so-called "empirical") system and the upholders of analytic (or "rational") valuation.

In his article, the writer has undertaken to show the necessity of giving to the analytic method the first place among the schemes of valuation, as being the one which, especially during periods of disturbance in the land market, is capable of rendering signal service.

After having pointed out the deficiencies of Aereboe's empirico-statistical method from the thoretical stand-point, the writer examines the practical application of this system in Italy. He bases his remarks upon the organisation devised by the partisans of this method which requires:

*a*) An exact classification of the land in each of the given districts to be valued.

*b*) The systematic registration of the sale and purchase prices, taking into consideration the class to which the land which is the subject of the contract belongs.

*c*) The systematic elaboration of the collected data and the determination of the average unit prices of each class.

*d*) A determination of the coefficients to be applied to the average unit prices, in order to make allowance for such factors as the situation of the land, means of communication etc.

The writer draws the following conclusions:

(1) Cp. Proposals for Reform of the Valuation System Based on the Inherent Capacity of the Soil. *B.* March 1914, No. 278. (*Ed.*)

1) The empirico-statistical method of valuation is quite impracticable in Italy, owing to the special conditions of landed property in that country, and also to the fact that such a system would necessitate the creation of district organisat ons which it would not be to the interest of any enterprise or association to establish.

2) Apart from this great objection, and supposing that the necessary organisation could be established in a suitable manner, the final result of the empirico-statistical method, namely the estimation of the value, would not be free from such errors of valuation as occur in the use of other methods, in view of the fact that the personal judgment of the appraiser would play an important part in this method, both in the elaboration of the data and in the comparative estimation.

3) The empirico-statistical method, which only gives one factor, *value*, is not adapted, like the analytic system, to the objects in view in the valuation of landed property, and still less to such matters as the cadastral system and loans on real property.

4) The method of analytical valuation at present largely adopted in Italy, should therefore not be condemned, nor even regarded as organically deficient; simply because its application presents practical difficulties which might be a source of error to the unexperienced.

## AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

227 — **Bákhar, the Indian Rice Beer Ferment.** — HUTCHINSON, C. M. and RAM AYYAR, C. S., in *Memoirs of the Department of Agriculture in India, Bacteriological Series*, Vol I, No. 6, pp. 137-168, 2 Plates. Calcutta, Octobre 1915.

"Bákhar" (known also as *murcha, ranu or u-t-iat* according to the various regions of India) is the ferment or culture artificially prepared for the manufacture of Hindu rice beer (*pachwai*) and of the rice spirit distilled therefrom. It contains mucorinae capable of converting rice starch and also alcoholic yeasts. Researches have been carried out on its preparation, composition, and action with a view to the Government control of its manufacture and sale.

The researches were directly concerned with the determination of: 1) The species of micro-organisms present in the various samples of *bákhar*; 2) the physiological activity of these micro-organisms in relation to their saccharifying power and alcohol production; 3) the function of various substances added to the ferment, *e. g.* roots, stems or leaves of jungle plants; 4) the reciprocal relationship between beneficial and detrimental organisms found in the bákhar or easily introduced during its use; 5) the possibility of acquiring a sufficient knowledge of the fermentation process so as to be able to instruct the manufacturers in better and more reliable methods of making this ferment.

The method practised by the natives consists in making a thick paste of the ground rice with water to which is added small quantities of powdered roots, leaves or stems of certain plants and condiments. This

paste is made into small cakes or balls which are then dusted over with the powder of old cakes. They are kept in a dark place for 3 or 4 days, after which they are dried in the sun and stored in a dry place until required for use. This method of preparation is varied in different regions by the addition of various plants or condiments, sometimes smoke dried and powdered before mixing with the rice paste. In making the beer the pulverised *bákhar* is added to the half cooked rice at the rate of 1 part per 100. This mixture is then put into baskets for 24 hours, during which the mucor penetrates the mass and begins the saccharification of the starch. It is then placed in earthenware vessels with water and fermented 3 to 5 days. The liquid is then filtered and may be used as pachwai (rice beer) or for the distillation of alcohol.

Several samples of bákhar from various sources have been submitted to biological analysis, making cultures on ammonium nitrate agar. Their composition was found to be as follows :

| | | |
|---|---|---|
| 1. | Darjeeling . . . . . | *Rhizopus Cambodja* (Chrzaszez) Vuill.<br>*Dematium*<br>*Penicillium*<br>1 species of yeast |
| 2. | Ranchi . . . . . | *Mucor Prainii*, *Dematium* . . } numerous colonies.<br>*Aspergillus niger* |
| 3. | Purulia . . . . . | *Rhizopus*., *Dematium*, Yeast . . } weak growth |
| 4. | Chaibassa . . . . . | *Mucor Prainii*<br>*Dematium*<br>2 species of yeast |
| 5. | Balasore . . . . . | *Mucor Prainii* - abundant<br>*Dematium*<br>2 species of yeast - numerous colonies. |
| 6. | Rajmahal . . . . . | *Mucor Prainii* - abundant<br>*Rhizopus* - not numerous.<br>No yeasts. |
| 7. | Dumka . . . . . | *Mucor Prainii* - abundant<br>*Dematium*<br>*Rhizopus*<br>Yeast |
| 8. | Sambalpur . . . . . | *Mucor Prainii*<br>*Dematium*<br>Yeast |

Cultures of the same kinds of *bákhar* were also made on ordinary agar and in addition to mucorineae, species of bacteria in limited numbers were obtained from the samples from Ranchi, Balasore and Rajmahal. Some of these samples also showed the presence of *Aspergillus niger* a fungus which is injurious to saccharifying species.

To determine the saccharifying power of the various kinds of *bákhar* 1 gr. of each sample was inoculated into 100 gr. lots of steamed rice and

incubated at 30° C. for 4 days after which the sugar content was determined by Fehling solution. The results were as follows:

| | | | |
|---|---|---|---|
| 1. Balasore | 80.6 | 5. Rajmahal | 39.6 |
| 2. Purulia | 60.9 | 6. Darjeeling | 25.4 |
| 3. Chaibassa | 58.5 | 7. Dumka | 12.4 |
| 4. Ranchi | 41.2 | 8. Koji (Japan) | 128.4 |

Thus the "*koji*" ferment from Japanese rice beer has a much stronger saccharifying power than the samples of Indian *bákhar*. The former consists of a practically pure culture of *Aspergillus Oryzae* (Ahlburg) Cohn. on entire rice grains.

Pure cultures of a certain number of the fungi were sown in 1 per cent starch solutions and incubated at 30° C. The number of days required for the complete disappearance of the starch was as follows:

| | | | |
|---|---|---|---|
| *Aspergillus Oryzae* | after 8 days | *Mucor javanicus* | after 27 days |
| *Aspergillus niger* | » 17 » | | |
| *Rhisopus Cambodja* | » 17 » | *Mucor Prainii* | starch present |
| *Dematium* | » 20 » | *Monilia* | after 30 days. |

Later saccharification experiment with the same species and with steam-cooked rice grains showed the superiority of *Aspergillus Oryzae*. They also showed that the intensity of growth and hence of saccharifying power of the various species of fungi in rice depends largely on the conditions of temperature, humidity and aeration. It is therefore of great importance to know the optimum conditions for each species and to maintain them during the process of saccharification.

To determine the fermentative power of Indian *bákhar*, lots of 100 grs. of steamed rice were inoculated with samples of 1.5 gr. of *bákhar* from four different sources. The mixtures were incubated at 30° C. in cottonwool stoppered bottles for 24 hours after which 250 cc. of water was added to each bottle and the cultures incubated for a further period of 5 days at 30° C. A further addition of 150 cc. of water was made and the whole contents then distilled. The esults were as follows:

| Source of *bákhar* | Quantity of liquid distilled | Specific Gravity at 20° C | Quantity of pure alcohol |
|---|---|---|---|
| Dumka | 104 cc | 0.961 | 61.6 cc |
| Ranchi | 100 " | 0.965 | 53.5 " |
| Darjeeling | 80 " | 0.959 | 49.5 " |
| Balasore | 95 " | 0.986 | 46.3 " |

Other cultural and fermentation experiments were carried out to determine the part played by the vegetable matter added to the *bákhar* by the natives.

The results of these experiments lead to the following conclusions:

1) These materials are of no value as inocula.

2) After the addition of these materials the colonies of yeast formed in the *bákhar* become more numerous and more vigorous so that by the time the starch is transformed into sugar, the yeasts are easily able to predominate over the harmful bacteria present in the rice.

3) These materials are also directly injurious to the development of bacteria in the *bákhar*, but the function of these materials both as food for the yeasts and as an antiseptic is confined to the *bákhar* and does not extend to the fermentation of the liquid, the quantities added being too small to be effective in the wet rice or in the rice beer.

4) These materials appear to have no direct effect on the odour and flavour of the beer.

A further experiment shows the fermentative action of various kinds of *bákhar* prepared in the laboratory, made up of combinations of pure cultures of the fungi with a strain of yeast. The best results were obtained with a mixture of *Aspergillus Oryzae* and *Saccharomyces cerevisiae* D isolated from *bákhar* from Khasi.

The principle conclusion of these investigations is that the non-success of *pachwai* is not so much due to the absence of efficient amylo-ferments as to that of good types of saccharomycetes.

For this reason the brewer is recommended to make use of the active wash from his own vats to inoculate the rice previously saccharified with the *bákhar* ferments or failing this to obtain a separate supply of yeast from a reliable source.

228 – **The Sugar Industry of the Philippines Islands.** — HINES, C. W. (Sugar Technologist, Bureau of Agriculture, Manila) in *The Louisiana Planter and Sugar Manufacturer* Vol. LV, No. 19, pp. 300-302. New Orleans, November 6, 1915.

The production of sugar in the Philippines for the year 1914 amounted to 370 000 long tons most of which was made into the molasses type of muscovado sugar and sold as " bayon " or " mat " sugar, " pilon " sugar and " panocha " sugar.

" Bayon " or " mat " sugar is packed in " bayones " or palm leaf bags, hence its name. The juice is simply clarified by the addition of a small quantity of lime and concentrated in a battery of iron kettles. On cooling a pulverised yellow or dark product is secured.

" Pilon " sugar takes its designation from the name of the bell-shaped earthenware jar in which it is made. Each jar has a capacity of 130 to 180 lbs. of crude sugar and is provided with a hole about 2 inches in diameter at the bottom, through which the molasses drain away. The refining process begins before the sugar is removed from the earthern jars. A layer of clay is applied to the top and kept saturated with water which assists in washing away the molasses adhering to the crystals. The jars are then broken and the white upper portion of the lump is dissolved, clarified with milk of lime white of egg and finally re-crystallised during constant stirring. These sugars are often fairly white in colour and polarise over 99 per cent.

" Panocha " sugar is made by moulding the heavy massecuite into

semi-spherical cakes when it has nearly cooled. Coconut shells are often used as moulds. The clarification and evaporation is identical with the processes used for the "pilon" and "bayon" sugars. It is largely used by the natives for home consumption, and during 1914 more than 24 000 tons of this sugar, were consumed locally.

At Malabon a sugar refinery has been established using the local sugars, from which it turns out 25 tons of finished sugar per day. There are also several first class centrifugal factories for producing test sugar.

Sugar cane is grown throughout the islands but there still remain vast fertile areas many of which produce only a single crop of rice each year or lie fallow.

229 – **The Fibre Industry of Mauritius.** — STOCKDALE, F. A. in *Department of Agriculture, Mauritius, Bulletin* No. 5, pp. 1-15. Mauritius 1915.

The fibre industry is, after sugar, the most important agricultural industry of the colony of Mauritius. The "Creole aloe" (*Furcraea gigantea* var. *Willemetiana*) and the "Malgache aloe" (*Furcraea gigantea*) are the commonest fibre plants; it is estimated that they cover about 20 000 arpents, (arpent = 1.043 acre). There are also some 1 500 arpents that have been planted in the Creole variety. *Agave rigida* var. *sisalana* (sisal) was introduced during 1905-1910; it is estimated that there are 60-75 arpents planted with sisal in the colony. These plantations require greater care, in the early stages, than do plantations of "Creole aloes".

Cutting leaves is usually carried out by task work. The cutters are paid on the average at the rate of 11 ½ d. per 100 packets, and it is generally estimated than one packet of leaves contains from 12-15 leaves and produces 1 kilo of green fibre, and 0.175 kilo of dry fibre. The aloes are usually cut every 2 years; the number of leaves taken off at each cutting varies greatly with the district and with the age of the plants.

From figures collected at various factories, it apperas that an average of 65 000 leaves of Creole aloes will produce one ton of dry fibre. This gives an average fibre recovery of nearly 2.3 per cent on the weight of the leaves. Wet fibre gives an average yield of from 16 to 18 per cent. In 1913 there were 42 factories in operation, of which 25 were situated in the Black River district. Their average output is 55 tons of dry fibre with a minimum of 50 and a maximum of 100 tons.

The "grattes" (fibre scraping machines) are manufactured in the machine shops of the Colony and cost from £14 to £18 each. They are capable of producing $^1/_{10}$ ton of dry fibre per gratte, per diem, and are fed by hand and worked in series, being driven by steam or suction gas engines. At the end of 1914 there were 11 suction gas engines with a brake horse power ranging from 18 to 40.

The Government of the Island of Mauritius has taken in hand the matter of machinery for fibre production and is installing in the Black River District a new Corona Automatic Decorticating Machine with a view to ascertaining whether reduction in the costs of production cannot be effected.

In the annual report of the President of the Chamber of Agriculture for 1911, it is stated that the cost of production per ton of dry fibre approx-

imated £11.15.0 where water is employed, and £14 where steam is used. The Royal Commissioners in 1909 obtained figures varying from £10 to £15 per ton. The costs of production were carefully enquired into during 1914. The transport of the leaves is naturally a very important item. However, in the following table are given the data obtained in the different factories according to the machines used ; the effect of distance upon the transport cost of the raw material has also been taken into account.

The difficulty of finding "gratteurs" to feed the "gratter" makes the use of an automatic feeder increasingly necessary, and a small automatic feeding machine is being constantly enquired for, in order to reduce the cost of production still further.

*Average Cost of Production per Ton of Dry Fibre.*

| | Factory with water-power | | | | Factory with suction gas | | | | Factory with steam | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | s. | d. | £ s. d. | £ | s. | d. | £ s. d. | £ | s. | d. | £ s. d |
| Cutting leaves . . . . | 2 | 5 | 0 | | 2 | 5 | 0 | | 2 | 5 | 0 | |
| Transport of leaves to factory . . . . . | 1 | 5 | 0 | to 2 0 0 | 1 | 5 | 0 | to 2 0 0 | 1 | 5 | 0 | to 2 0 0 |
| Feeding leaves to grattes . . . . . | | 8 | 0 | | | 8 | 0 | | | 8 | 0 | |
| Decorticating . . . . . | 2 | 13 | 4 | | 2 | 13 | 4 | | 2 | 13 | 4 | |
| Skins for gloves for gratteurs . . . . . | | 6 | 0 | | | 6 | 0 | | | 6 | 0 | |
| Removal of residue . . | | 4 | 0 | | | 4 | 0 | | | 4 | 0 | |
| Fuel, oil and attendance . . . . . | 1 | 0 | 0 | | 2 | 0 | 0 | | 4 | 0 | 0 | |
| Transport of green fibre to basins . . . . . | | 3 | 0 | | | 3 | 0 | | | 3 | 0 | |
| Soap . . . . . | | 13 | 4 | | | 13 | 4 | | | 13 | 4 | |
| Washing . . . . . | | 3 | 0 | | | 3 | 0 | | | 3 | 0 | |
| Drying . . . . . | | 8 | 0 | | | 8 | 0 | | | 8 | 0 | |
| Brushing . . . . . | | 8 | 0 | | | 8 | 0 | | | 8 | 0 | |
| Baling . . . . . | | 8 | 0 | | | 8 | 0 | | | 8 | 0 | |
| Transport to Port-Louis | | 7 | 0 | to 1 0 0 | | 7 | 0 | to 1 0 0 | | 7 | 0 | to 1 0 0 |
| Miscellaneous . . . . . | | 8 | 4 | | | 8 | 4 | | | 8 | 4 | |
| Total . . . | £11 | 0 | 0 | to 12 8 0 | 12 | 0 | 0 | to 13 8 0 | 14 | 0 | 0 | to 15 8 0 |

The exportation of fibre from Mauritius reached its maximum in 1900, being 3105,3 metric tons. In 1913, it was 2912 tons. From 1899 to 1913 the average export was 2134.4 metric tons and its average yearly value was £45 306.

The industry is worked on very small capital and therefore it does not increase as might be expected, considering the suitability of soil and climate. With wider plantings, the centralisation of factory work would be possible, and it would pay to erect an up-to-date factory of which the cost is estimated at £3 000 to £3 500. The cost of planting and bringing fibre into bearing, including expenses of supervision might be estimated at £10 per acre for areas of 100 acres or upwards.

In order to establish for Mauritius fibre a reputation in the world's markets, grading of fibre according to length, colour and strength should receive closer attention.

230 – **The Canned Fruits Industry in California, United States.** — BENTRY, C. H. *Monthly Bulletin of the State Commission of Horticulture*, Vol. IV, No. 8, pp. 361-368. Sacramento Cal., August 1915.

The writer mentions the fruits that are of chief importance to the canning industry in California. The following is a brief summary.

APPLES. — *Newtown pippins* are the best and the greater part of the 2500 tons canned annually in California consists of this variety. They are mostly put up in large tins for hotels and pie bakers, peeled, cored and quartered, ready for use. A limited quantity is packed in smaller tins for use in the tropics, the undersized fruit is largely used for the pie grade, and the average price paid is from $10 to $12 per ton. The apples for canning purposes come largely from Sonoma, Santa Clara and Santa Cruz counties.

PEARS. — *Bartlett* pears are in great demand and canners use ordinarily about 20 000 tons per annum.

The price ranges from $30 to $40 per ton, sometimes in years of light crop running to higher figures. Canners require the fruits to be free from scab and worms and not less than 2¼ in. in diameter. In preparation the fruit is peeled, halved and cored, and is graded over and worked up as it ripens, for it is better when picked before ripening. This variety seems to promise the grower the best results for years to come, for it arrives in good condition and is in great demand on the market being much liked also by the preparers of dried fruit.

APRICOTS. — The *Royal*, *Blenheim* and *Hemskirk* varieties give the best results. In a normal season, 20 000 tons are canned. The average price for the past five years at the cannery has been $30 per ton. Fruit of good size with a clear skin, golden colour and firm texture is desired. As a rule, apricots are canned unpeeled, as the skin gives a peculiar flavour, and therefore the canner is very particular about apricots being free from fungus or skin blemish. The *Moorpark* variety which is much prized for its flavour, has the disadvantage of ripening unevenly.

PEACHES. — The canner wants a peach of golden colour, of good size, symmetrical, without colour at the pit, and with a small pit. For these reasons, of the freestone varieties he prefers the *Muir* and the *Lovell*. The latter usually command a higher price than the other freestone varieties, although it ripens in late August, when the canner is overtaxed with many varieties of fruit. If a peach similar to the *Lovell* could be developed to ripen in July, or in the middle of September, it would be in high favour.

About 24 000 tons are canned annually with prices of about $22.50 per ton for *Lovell*, and $17.50 for other varieties, like the *Muir* and *Early Crawford*. Other varieties which may do well for shipping purposes, like *Alexander*, *Hale Early*, *Mary's Choice* and *Picquets Late*, are not desirable for canning.

In spite of the increased difficulty and expense of removing the pit, yellow clings are the most desirable of all Californian canned fruits, and more of these are canned, than of any other variety. Different varieties have been propagated from the original *Lemon Cling*, so that the canner gets an almost continuous season from late July to late September, beginning with *Tuscans*, *Orange*, *Mc Kevitt*, *Sellers* and *Phillips* and ending with *Late Levy* clings. The first and the two last are the most popular. The average price for *Phillips* and *Tuscans* is about $ 25 per ton, and for other varieties $20. As with the freestone peaches, the clings are graded, peeled, halved and pitted. About 35 000 tons are used annually for canning. The *White Heath Clings* were formerly quite popular, but did not bear well enough to suit the canners, while *George's Late*, which was grown on a large scale, was not satisfactory to the consumers. A good white cling like *Mc Kevitt*, if it ripened in September, would fetch a higher price than the yellow clings. About 900 tons are, at present, used for canning.

PLUMS. — *Egg plums*, *Greengage*, *Golden Drop* plums and similar varieties are used to a limited extent for canning; about 2500 tons are tinned annually and the price is usually from $15 to $20 per ton. The fruit is merely stemmed, graded and washed and is packed whole without peeling or pitting. Buyers object to the coloured varieties, as they discolour the syrup.

CHERRIES. — About 1 200 tons of *Royal Anne* and white varieties are used annually for canning and probably about 450 tons of black varieties. The average price of the former is from 5 cents to 6 cents per pound, while the latter only fetch about 3 ½ cents or 4 cents per pound. The trade demands a clear transparent syrup, and for this reason black cherries are less used for canning. *Royal Anne* cherries, when grown in the shade, are waxy and white and therefore are the most prized. The greatest number come from the north central counties of California and are bought by shippers and by packers in Maraschino, as well as by canners.

GRAPE. — The Muscat, or raisin grape, is canned to a limited extent, about 1000 tons are used annually at a price of about $12 to $15 per ton.

BERRIES. — Blackberries are used extensively by canners, about 2000 tons being tinned annually. The *Mammoth* and *Lawton* varieties are the most common and fetch about $40 per ton. Far better results are secured with *Loganberries* (a hybrid between the blackberry and raspberry). The price of these fruits ranges from $55 to $ 75 per ton; they are in great favour in the fresh fruit market, as well as with the canner and the buyer of dried fruit. Canners use about 750 tons; the *Phenomenal* variety seems to be preferred. In the dried form, loganberries are likely to supplant the dried raspberries, they sell for some 23 cents to 25 cents per pound.

The canning industry has not yet found a variety of strawberries or

raspberries of sufficiently firm texture and high colour. The varieties commonly grown are more suitable for jams and jellies than for preserves The *Longworth* of the Alviso and Santa Clara districts has become too small to give satisfaction to the canner, or consumer. These varieties ordinarily bring $ 60 to $ 70 per ton, while the *Clarke, Wilson* and other similar varieties grown in Oregon bring $100 per ton, being more hardy and better for shipping. About 800 tons are used by canners and preservers, but a much larger quantity could be employed of better varieties. The *Cuthbert* and *Antwerp* varieties of raspberries are commonly grown ; canners use about 100 tons annually, but more would be used if prices were nearer the limits acceptable to growers in Oregon and Washington.

Gooseberries are used to a limited extent for jams and jellies. If the large English gooseberry grown in Oregon were produced in California, canners would pay a high price.

In Texas, a small white fig of good quality is grown which is canned to a considerable extent ; there would seem to be an opportunity for development in California.

The method generally employed in the canning industry is as follows: the fresh fruit, properly prepared, is put into the can *ad hoc* ; sugar syrup is then added, merely for flavouring, and the can is hermetically sealed and sterilised by heat.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

231 – **The Cause of the Loss of Nutritive Efficiency of Heated Milk.** — Mc Collum, E. V. and Davis, Marguerite. (Laboratory of Agricultural Chemistry of the University of Wisconsin) in *The Journal of Biological Chemistry*, Vol. XXIII, No. 1, pp. 247-264, 6 charts. Baltimore, Md., November, 1915.

In order to learn what factor is involved in the loss of efficiency of milk during heating, a series of feeding experiments was made in which a ration of polished rice (previsously heated at 15 lbs. pressure in an autoclave) casein in varying amounts, butter fat, and a salt mixture, was supplemented with heated preparations from milk as follows :

*a*. Milk from which the casein had been removed (whey), heated in autoclave.
*b*. Milk from which the casein and albumin had been removed, boiled six hours.
*c*. Lactose (heated in autoclave).

The following conclusions were reached :

1. Skim milk powder which has been wet and long heated in a double boiler or heated for a period of one hour in an autoclave at 15 pounds' pressure no longer supports growth as does the unheated product. When heated, milk powder also loses its property of supplementing certain rations made up of polished rice, plus salts ad butter fat ; *i. e.*, rations which require both protein and water-soluble accessory to make them support growth.

2. Wheat embryo, which is as efficient as milk powder in supplementing such rice rations, can be heated for one hour in an autoclave at 15 pounds' pressure without manifesting any deterioration in this respect as does milk.

3. Skim milk from which the casein has been removed (whey)

can be heated in an autoclave at 15 pounds' pressure for one hour without noticeable loss of its nutritive properties. It still supplies the water-soluble accessory in active form.

4. Whey from which the albumin has been removed by coagulation can be kept at the boiling temperature for six hours without any appreciable loss in its activity as far as the water-soluble accessory is concerned. Also lactose which has been heated in an autoclave for one hour at 15 pounds' pressure, still behaves as does the unheated product in supplying to rations the water-soluble accessory.

5. Heating casein in a moist condition for one hour in an autoclave at 15 pounds' pressure destroys its biological value as a complete protein.

6. Heated casein or heated milk powder are shown to have little if any toxicity. The deterioration is due to a loss of value of the protein fraction of the ration through changes wrought in the casein.

232 – **Researches on the Proteolytic Action of Lactic Ferments.** — GORINI, COSTANTINO in *Atti della Reale Accademia dei Lincei*, *Series V*, Vol. XXVI, No. 10, pp. 470-475. Rome December 7, 1915.

In a previous paper (*Rendiconti dell'Istituto lombardo di scienze e lettere*, 1907, p. 947; 1908, p. 122) the writer in describing a type of acid rennet producing bacteria isolated from the cows udder, gave the first example of a lactic ferment showing proteolytic action only in milk and not in gelatin cultures. In a later paper (*Rendiconti della R. Accademia dei Lincei*, 1910, p. 150) a second example is given in describing a type of acid rennet producing coccus isolated from cheese. Thus the inability to liquefy gelatine is a sufficient criterion of the absence of peptonising action in a given lactic organism on the casein of cheese. It is shown that this difference in behaviour is not attributable to a difference in the proteolytic enzyme acting on the gelatin and that acting on the casein. If some drops of a peptonised lactic culture of these bacteria are added to sterile gelatine and kept for several hours at ordinary temperatures or even in ice, the gelatin is liquefied, thus proving the peptonising action of the proteolytic enzyme in the lactoculture.

The writer at first considered that this difference in behaviour was due to the fact that the gelatin was not sufficiently favourable to the development of the bacteria, but other types of lacto-caseolytic ferments were found to be unable to liquefy gelatine though they grew vigorously in it. Another interpretation was therefore necessary.

The researches carried out with this object are summarised as follows :

The influence of the substratum on the proteolytic activity of lactic ferments is confirmed. It is particularly obvious in comparing the behaviour of certain lactic ferments in gelatine and milk culture. Thus, whilst the milk becomes peptonised, the gelatine is not liquefied, though the caseolytic enzymes of milk show peptonising action on gelatine. This influence of the medium is also seen in comparing the behaviour of the lactic ferments in liquid milk and in solid agarmilk cultures. It follows that the caseolytic action of certain lactic ferments is uncertain owing to indefinable causes and

is apparently dependent on changes taking place in the milk before, during or after sterilisation in the laboratory.

The percentage of soluble albuminoids (peptones) in milk is one of the causes of the uncertain activity of the caseolytic activity of the lactic ferments, especially in the case of retailed milk. By analogy it may be inferred that the inability of certain lacto-caseolytic ferments to liquefy nutritive gelatine is due to the soluble albuminoids (peptones) that they contain, and also that the stimulus producing the proteolytic enzymes in certain lactic ferments is subordinate to the necessity of producing soluble nitrogen for their own needs. When the soluble nitrogen is already present in sufficient quantity in the medium, the dissolving enzyme is no longer necessary.

Whatever may be the correct explanation, it is certain that to judge the proteolytic power of a lactic ferment both gelatine and milk cultures are inadequate. Experiments should be made with various quantities of milk, taking into account particularly the differences there may be between fresh and commercial milk, especially with regard to the percentage of soluble albuminoids due to bacterial and enzyme action.

Considering the previous results obtained by the writer (*Rendiconti della R. Accademia dei Lincei*, 1915, 24, p. 369) on the influence of temperature on the proteolytic action of lactic ferments, it is obvious what precautions are necessary before the caseolytic power of a lactic ferment in an acid medium can be excluded; and how it may be assumed that this power is more widespread than appears from the experiments carried out without recognising these influences.

233 – **Rational Preparation of Rennet from the Stomach of the Calf, Sheep and Goat.** — Besana, C. in *L'Industria Lattiera e Zootecnica*, Year XIII, No. 24, p. 336, Reggio Emilia, December 15, 1915.

The old method of preparing rennet paste consisted in drying the stomach with its caseous contents, cutting it into small pieces and mixing with salt, after which it is moistened with water to form a consistent paste and left to stand for some time to increase its coagulating power.

The rational method requires a thorough cleaning of both surfaces of the abomasum, since the active ferment is secreted by the membrane and not by the casein. The dried stomachs for the preparation of liquid rennet or infusion of rennet are known as " pellettes " in commerce. The essential condition in the preparation of the " pellettes " is that the animals used should have been fed entirely on milk, otherwise the coagulating power of the glands diminishes considerably.

The " pellettes " should be prepared in the following manner :

1) Take the abomasum from the freshly killed animal and remove all traces of the casein.

2) Remove all adhering fat.

3) If the abomasum is dirty, it should be washed lightly and rapidly in ordinary water.

4) Tie the one of the open ends of the stomach with a thread and inflate it from the other end.

5) Whilst inflated, tie open end and hang up the balloon to dry.

6) When completely dry, remove the threads and compress gently until completely collapsed.

In this form the " pellettes " are ready for use and are sold by the dozen or hundred. They keep well for several months when protected from dampness, heat and maggots. Their coagulating power increases appreciably with age up to a certain point, after which it decreases and finally disappears completely.

AGRICULTURAL PRODUCTS: PRESERVING, PACKING, TRANSPORT, TRADE

234 – **The Spontaneous Heating of a Heap of Oats.** — HOFFMANN, J. F., in *Zeitschrift für Spiritusindustrie*, Year 38, No. 52, pp. 509-510. Berlin, December 30, 1915.

An article on the spontaneous heating of a heap of oats of which the cubic content was 523 cubic yards. Some of the oats had been harvested before they were completely ripe and, at the end of November, the fermentation temperature of the heap was so high that it was feared that spontaneous combustion would take place. With the object of ascertaining whether it is more profitable to feed such fermented oats to cattle, or to use them as raw material for distilling, the writer studied the spontaneous heating of the heap of oats. He chose 6 different samples, of which the water content varied from 8.7 per cent to 22.1 per cent. The lighter-coloured samples were distinguished from the darker-coloured by their smaller number of black oats. Generally oats of every shade from light brown to black were to be observed. All the 6 samples had a characteristic and slightly acid odour (especially the straw) which was probably due to the presence of acetic acid and of formic acid (this question has not been thoroughly studied by the writer). In some cases, however, the acid smell was concealed by the odour of other substances (formaldehyde, etc). The black grains had a strong and disagreeable acid flavour.

In order to determine whether the oats in question could be used for distilling, the writer made a fermentation test with 4 samples of oats taken from the above-mentioned heap. From 220 lbs of raw material he obtained the following amounts of alcohol :

| | 1 | 2 | 3 | 4 | Normal oats |
|---|---|---|---|---|---|
| Alcohol, gallons . . . . . | 1.72 | 2.86 | 3.30 | 4.53 | 5.72 to 6.16 |
| Yield, per cent. . . . . | 29 | 48 | 56 | 76 | 100 |
| Decrease in yield due to spontaneous heating, per cent.. . . . . | 71 | 52 | 44 | 24 | 0 |

Sample No. 1 was of a black colour and damp; No. 2 was dry and black; No. 3 was light-coloured and damp; No. 4 light-coloured and dry. On comparing these results with the feeding results, it was found that oats which had become heated spontaneously were more suitable for making alcohol than for using as a cattle feed. If such oats must be fed cattle, they should be mixed with unheated oats.

The primary cause of spontaneous heating is water. The larger the water content, the greater the respiration of the vegetative cells, and the more the temperature of the heap rises. This phenomenon is also promoted by the large amount of fatty matters present in the oats. At high tempera-

tures, the fatty matter absorbs large quantities of oxygen, thus encouraging oxidation. Together with oxidation, there is a large formation of carbon, which substance, in its turn, also absorbs large quantities of oxygen, thus promoting oxidation. All these different factors often raise the temperature of the heap of oats to such a height that cases of spontaneous combustion are produced.

235 – **Grading Maize in Rhodesia.** — *The Rhodesia Agricultural Journal*, Vol. XII, N. 5, p. 600. Salisbury, Rhodesia, October 1915.

In order to facilitate the export of this year's large surplus of maize in excesss of internal requirements, and in particular to aid the Farmers' Cooperative Society and other exporters in their endeavour to establish uniform standards of quality of grain to place on overseas markets, the Government of Rhodesia has this season, for the first time, employed graders to travel throughout the grain districts and examine every bag of the immense stocks of maize at the railway stations and sidings where they were stacked ready to be entrained. Graders' certificates have been issued for two qualities only, *viz.* Flat White No. I (F. W. I) and Flat White No. II (F. W. II.), these being the classes registered in Europe at the various Corn Exchanges, where samples are deposited for the buyers' guidance. The grader's mark on the bag is the buyer's guarantee that the grain is up to this standard. The percentage of rejected bags has been very small. The chief reasons leading to rejection have been dampness, dirtiness, careless sacking and too high a proportion of discoloured and broken grains.

The difficulties of the work the first year have been considerable, principally owing to the irregular delivery of grain. All this work has been done free of charge, but the results have been so satisfactory as to repay amply the labour expended.

236 – **Cantaloupe Marketing in the Larger Cities with Car-Lot Supply, 1914.** — SHERMAN, W. A., GAIL, A. D. and YEAW, F. L. in *U. S. Department of Agriculture*, Bulletin No. 315; *Office of Markets and Rural Organisation*, pp. 1-20. Washington, October 23, 1915.

The Office of Markets and Rural Organisation of the United States Department of Agriculture has published the data collected by an enquiry on the car-load marketing of cantaloupes in the United States. It was sought as far as possible to trace for a certain number of car-loads of cantaloupes their distribution from the point of production to the consumer, records being made of all changes in possession or ownership and of added charges. Thus an endeavour was made to secure the following items of information: Car number and initials; point of origin, consignor; consignee; selling fees of the marketing association; distributor; local buyer, or solicitor; date of shipment; date of arrival on market; date car was opened; date released; freight; refrigeration; demurrage; condition of stock on arrival; cartage charges; gross profits of brokers, wholesalers or commission merchants and retailers.

In addition to the above work on car-loads observations were made of all factors which affected the cantaloupe market, either favourably or unfavourably.

### Systems of distribution within cities.

Where investigations were made, it was found that the principal channels of distribution after the car reached its destination were as follows:

| I | II | III |
|---|---|---|
| 1. Broker. | 1. Broker. | 1. Wholesaler or commission merchant. |
| 2. Wholesaler or commission merchant. | 2. Jobber. | 2. Jobber. |
| 3. Jobber. | 3. Retailer. | 3. Retailer. |
| 4. Retailer. | 4. Consumer. | 4. Consumer. |
| 5. Consumer. | | |

Many firms in the smaller markets combine the functions of the wholesaler and jobber by selling either to the jobber or the retailer, the prices as a rule being higher the smaller the quantities sold.

In most markets the broker figures more prominently in the distribution of western cantaloupes than of eastern stock. The practice of wholesale buying of eastern cantaloupes is probably explained by their lower delivered cost compared with that of western stock.

### Factors which influence prices.

The daily arrival of car lots of cantaloupes naturally plays an important part in determining prices. On the average large market these receipts are from several widely separated sections. Cantaloupes from California arrive on the New York market with those from Maryland; a section distant more than 3000 miles competing with a shipping area only some 200 miles away. On August 15, Texas points, 2100 miles distant from New York City, were sending their melons to compete with those from New Jersey. New Mexico and Nevada compete with Indiana and Illinois on the Chicago market and about the middle of August in Chicago the melons from eight different States were competing with each other.

This is rendered possible by transportation and refrigeration facilities. The question of competition narrows itself to a comparison of appearance and quality of the melons and the difference in freight and refrigeration rates from the competing areas. If the melons from California and Texas are not superior in some way to those from Delaware, Maryland and Michigan, they cannot profitably enter the same market unless the cost of production is sufficiently low to offset the increased freight and refrigeration charges. The superiority of cantaloupes grown under irrigation has been recognized in all the larger markets.

The tables given by the writers of car-load freights and refrigeration from several cantaloupe shipping sections to twelve of the large markets show to what extent the cost of carriage allows the various centres of production to compete with each other.

Among the numerous packages used for cantaloupes in the various markets, the two that are used with best results are the "standards", holding 45 melons and the "flats", holding 9 to 15.

In 1914 great fluctuations in the demand for cantaloupes occurred, they were due to sudden changes of temperature in the Eastern markets and to the competition of other fruit that flowed in abundance to the great markets rendering the sale of melons difficult towards the end of the season which lasts from 4½ to 5 months.

The data collected by the Market Surveys Bureau for a few carloads with a view to following the changes in prices of the goods from the producer to the consumer cannot be generalised and are only illustrations of the specific cases that were examined. The great range of gross profits on the sales through retailers is striking. It was found to vary from 28.8 to 68 per cent on the investment in cantaloupes packed in standards and from 33 to 130 per cent on those in flats. The average gross profit per crate varied from $0.627 to 0.95 for the former and from $0.177 to 0.755 for the latter.

From the enquiry made in the spring of 1915 on the 1914 cantaloupe crop it appeared that about the middle of May the first important shipments of cantaloupes were made from the Imperial Valley in California, these were followed closely by shipments from Florida and southern Texas and then Georgia. The last being those from Colorado which begin about the middle of August and continue till the end of September.

Table I shows the cantaloupe shipping stations together with the number of carloads sent from them during the 1914 season. The Report contains also charts and diagrams showing the shipments from each county, time of ripening of the fruit and the duration of the productive period in the various States and from these data the writers have drawn a map like the one given below with No. 237.

TABLE I.

| State | Carloads | State | Carloads |
|---|---|---|---|
| California | 5146 | Nevada | 306 |
| Colorado | 2800 | Michigan | 300 |
| Delaware | 1260 | Texas | 271 |
| Indiana | 1243 | N. Mexico | 212 |
| Georgia | 1120 | S. Carolina | 205 |
| N. Carolina | 923 | New Jersey | 110 |
| Arizona | 585 | Virginia | 73 |
| Maryland | 528 | Tennessee | 52 |
| Arkansas | 453 | Missouri | 29 |
| Florida | 390 | Utah | 24 |
| Illinois | 325 | Washington | 22 |

237 – **Peach Supply and Distribution in 1914.** — SHERMAN, W. A., WALKER, H. F., MARTIN L. H. in *U. S. Department of Agriculture, Bulletin No. 298. Office of Markets and Rural Organisation*, pp. 1-15. Washington, August 31, 1915.

The peach season in the United States extends from the middle of May, when shipments begin in Florida, to the latter part of October, when they

end in the Northern States. California, with its diversified climate and great number of varieties of peaches, probably has the longest season, *i. e.* from the middle of May to the end of September.

For the study of the trade of the peach crop from the shipping centres to the great markets the writers propose grouping the various States as follows:

1) South eastern — Including the Carolinas, Georgia, Florida, Alabama, and eastern Tennessee.

2) South western — Including Texas, Louisiana, Arkansas, Oklahoma, and Missouri.

3) Eastern — Including Virginia, West Virginia, Maryland, Pennsylvania, Delaware, New Jersey and Connecticut.

4) New York.

5) Lake Districts — Michigan and Ohio.

6) Mountain Districts — Colorado, Utah, and New Mexico.

7) California.

8) North western — Including Washington, Oregon and Idaho.

The suggested grouping provides for practically all car-load movement, except from a few localities of minor importance in Kentucky, western Tennessee, southern Illinois, Ohio and West Virginia. These points might constitute a ninth group — the Ohio Valley.

The Office of Markets and Rural Organization, United States Department of Agriculture after a preliminary enquiry on the 1913 crop has published now the results of the enquiry as to the 1914 shipments, obtained from railroad officials, shipping agents, co-operative organizations and others known to be interested in the peach trade.

The object of the enquiries were to ascertain: 1) the relative importance of the various centres of production in which peach growing was so important as to allow of peaches being sold by car-loads in the great markets; 2) the time at which the shipping season begins in the various centres of production and its duration so as to know which of them compete with each other at the same time in the chief markets.

The ten leading States in the shipment of peaches in 1914, each showing shipments of more than 1000 car-loads are as follows:

| State | Carloads | State | Carloads |
|---|---|---|---|
| Georgia | 4803 | Colorado | 2075 |
| California | 2983 | West Virginia | 1978 |
| Washington | 2501 | New Jersey | 1556 |
| Ohio | 2340 | Utah | 1556 |
| Michigan | 2260 | Maryland | 1231 |

The other States shipped altogether 4705 car-loads, forming a grand total of 27 994 car-loads. In the tables given by the writers the numbers of car-loads sent by each county in the various States are reported.

The following diagram (fig. 1) shows in detail the comparative shipping season of the different States, and which of the latter can compete with each other in early or late produce.

It will be seen from the above diagram that the chief producing

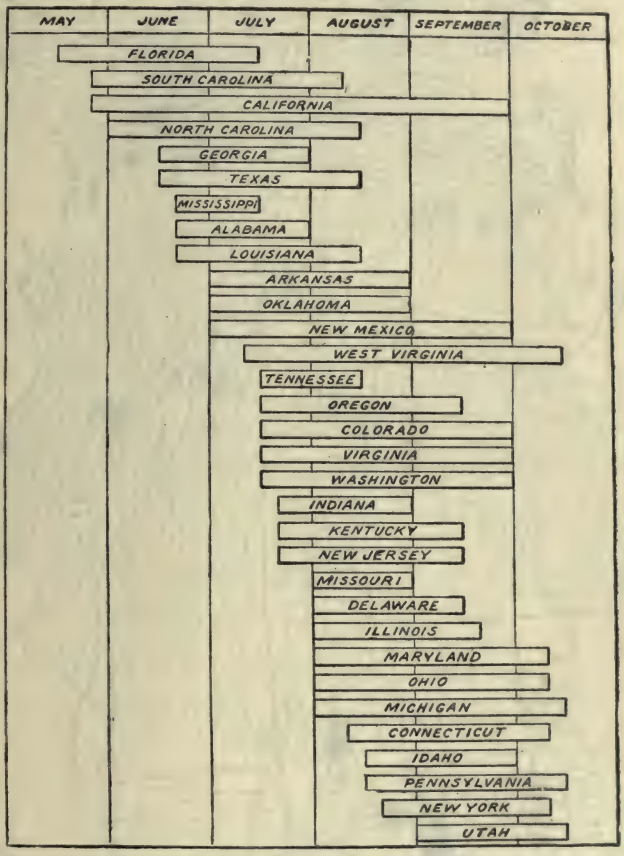



Fig. 1. — Peach-shipping season.

State, Georgia, exported its 4803 car-loads in a short period extending from the second half of June to the end of July, whilst California that follows immediately in number of car-loads namely 2983, shipped them between the end of May and the beginning of October, and Washington, the third State in point of importance of production began, its shipments at the beginning of July or only a fortnight before the end of the Georgia shipments.

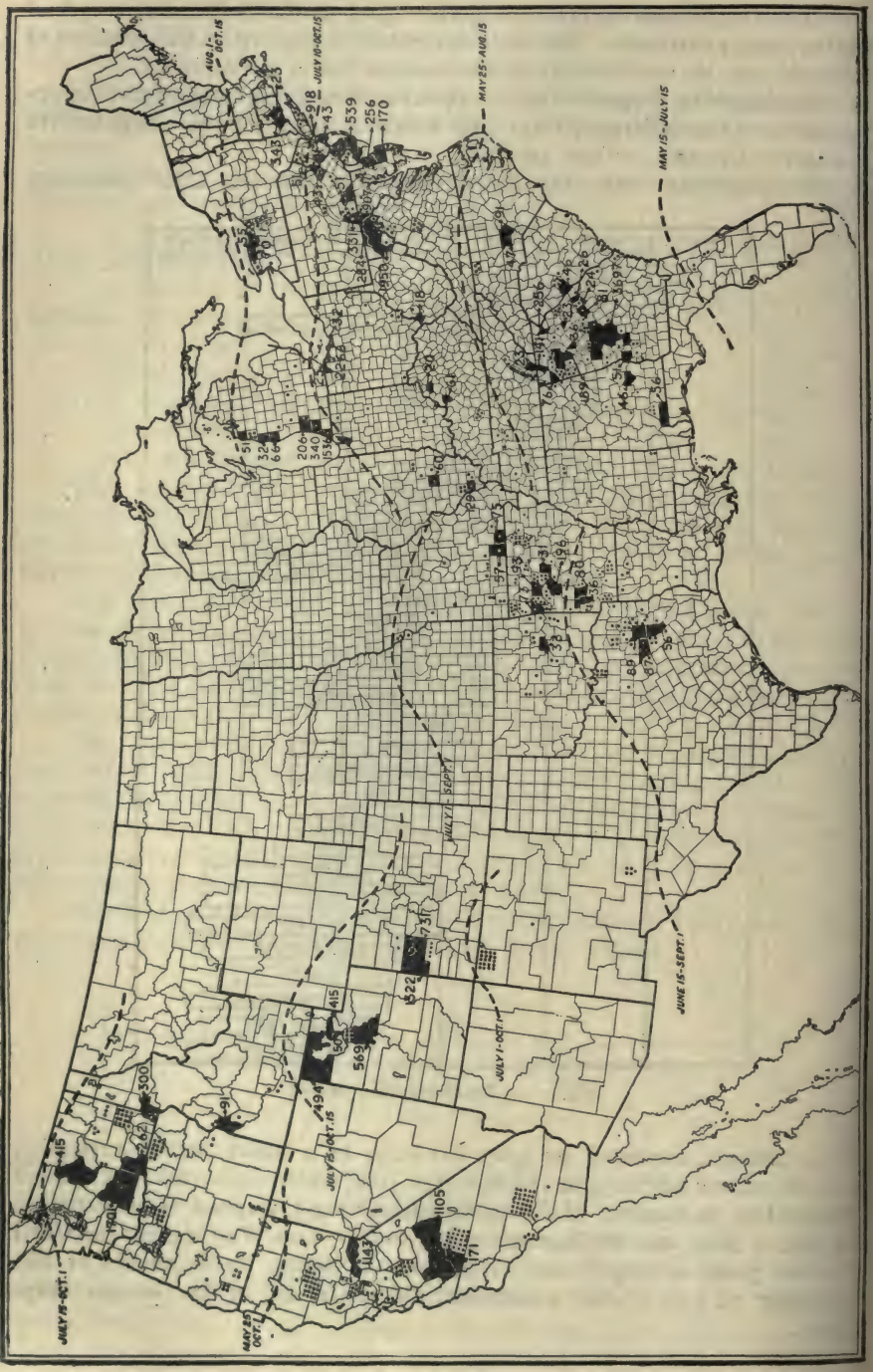



Fig. 2. — Map showing peach shipments in 1914.

With the object of pointing out the importance that the great centres of production, rather than the States to which they belong, have from this point of view and from that of their production and to show the curves of the geographical boundaries of the individual epochs of shipping, the following map, fig. 2, has been prepared. Each dot represents five car-loads or fraction thereof. The black areas represent the number of car-loads indicated by figures.

For the 1915 crop, estimates were secured from 571 shipping points (in 28 States), which in 1914 had sent off 22 877 car loads. The estimates made indicated a total of 43 623 cars in prospect for 1915 or an increase of 90 per cent.

From the Bureau of Crop Estimates' report a production forecast for the whole of the United States was made of 58 328 000 bushels as compared with a final estimate last year of 54 100 000 bushels.

# PLANT DISEASES

## GENERAL INFORMATION

GENERALITIES

238 - **Biochemical Researches on the Bacteriosis ("Rübenschwanzfäule") of the Sugar-Beet.** — BODNÁR, J., in *Kisérletügyi Közlemények*, Vol. XVIII, Part I, pp. 73-83. Budapest, 1915.

After a summary of the studies made by BUSSE, LINHART, FRANK, SORAUER, STIFT and others on the bacteriosis of the sugar-beet ("Rübenschwanzfäule") the writer describes the biochemical researches he carried out in 1913. From the results obtained he draws the following conclusions :

1. The sugar-beet attacked by bacteriosis has a smaller percentage of saccharose and of water, while the percentage of invert sugar, ash, acidity and alumina, is higher than in the sound beetroot cultivated in the same soil.

2. The presence of invertase may be demonstrated both in the diseased and in the sound part of the sugar-beet attacked by bacteria. It may be also obtained in a solid form.

3. It is probable that, in the diseased beet, the increased percentage of the inorganic compounds takes place before the bacterial invasion of the beetroot, and that this predisposition — if the theory of SORAUER regarding the origin of the disease be accepted — may be a sign of the weakened resistance of the plant. On the other hand, the changes in the percentage of saccharose and invert sugar, and also in the percentage of acidity, may be due to the vital action of the bacteria attacking the plant.

239 - **"Fumago" in the Department of Sotshi (Caucasus).** — VORONIKHINE, N. N., in *Trudy Bureau po pryxladnoj botanikie* (Works of the Department of Applied Botany, attached to the Ministry of Agriculture), Year VIII, Vol. 6 (80), pp. 769-807, 3 Tables with text. Petrograd, 1915.

The fungi which cause the production of "fumago" on the leaves of trees are the most widely spread representatives of the mycological flora of the department of Sotshi. The writer's researches, made in 1912-1913,

have shown that "fumago" is to be found not only on the coasts of the Black Sea, but also on the higher ground, spreading sometimes over an area of several square kilometers. The writer has identified, in the above named department, 11 species of small fungi which produce "fumago", 6 of which are new to science and are included in the genera *Antennullariella, Zukalia, Limacinula, Chaetothyrium* and *Triposporium: Antennulariella fuliginosa* Voronikhine on *Ilex aquifolium* L.; *Zukalia caucasica* Voronikhine on *Taxus baccata* L.; *Z. setosa* Voronikhine on *Prunus laurocerasus* L. and *Rhododendron ponticum* L.; *Limacinula caucasica* Voronikhine on *Taxus baccata* L.; *Chaetothyrium colchicum* Voronikhine on *Ilex aquifolium* L.; and *Triposporium tenue* Voronikhine on *Rhododendron ponticum* and *Staphylea colchica* L.

The diagnoses of the new species are in Latin.

240 – **On the Composition and Preparation of Bordeaux Mixture.** — SICARD, L., in *Annales de l'Ecole Nationale d'Agriculture de Montpellier*, New series, Vol. XIV, Part III pp. 213-253. Montpellier, 1915.

MEANS OF PREVENTION AND CONTROL

The writer's researches on the composition and preparation of Bordeaux mixture lead to the following conclusions:

I. The amount of lime necessary for rendering the copper completely insoluble is much less than that which most writers indicate. In actuality, when a milky solution of pure lime is poured slowly into a solution containing a kilogram of pure copper sulphate strongly stirred, the Bordeaux mixture obtained is acid only so long as the total of lime added is below 168.5 gms. that quantity being expressed in pure quick lime (CaO).

When the quantity of lime added amounts to 168.5 gms. all the copper is rendered insoluble. The mixture is then "neutral" and "has no excess of lime". For larger quantities of lime between 168.5 gms. and 225 gms., the mixture is still "neutral", but "has excess of lime". Finally when the quantity of lime is beyond 225 g, the Bordeaux mixture is "alkaline".

II. The so called "neutral" Bordeaux mixtures prepared in the vineyard by adding lime until the blue litmus paper ceases to turn red, are mixtures with more or less excess of lime and whose anticryptogamic value is much inferior to that of the neutral Bordeaux mixtures with no excess of lime.

III. To obtain a good Bordeaux mixture proceed in the following manner (for 1 hectolitre (22 gallons) at 2 %):

1) Dissolve 2 kg. of copper sulphate in 50 litres of water;

2) Take a volume of lime milk containing pure lime in a sufficient quantity to render insoluble all the copper of 2 kg. of copper sulphate and increase the volume of liquid to 50 litres.

The average volume of lime to be taken will be:

| | | |
|---|---|---|
| 4 | litres of lime milk at . . . . . | 9 Baumé |
| $3\frac{1}{2}$ | » » » » » . . . . . | 10 » |
| $3\frac{1}{4}$ | » » » » » . . . . . | 11 » |
| 3 | » » » » » . . . . . | 12 » |

3) Pour the copper sulphate solution very slowly into the lime milk, stirring it quickly either with the hand or, better, with a mechanical agitator. The more slowly the copper sulphate is added, and the longer and more strongly the ingredients are stirred, the better will the Bordeaux mixture succeed.

Generally, as soon as all the copper sulphate is added, the mixture is acid, but shortly afterwards, when the action of the lime is ended, it ceases to be so. The Bordeaux mixture is then neutral and without lime excess.

This mixture is pale blue and may be kept indefinitely without deteriorating.

241 – **Sterilisation of Seeds by Calcium Hypochlorite as Means of Controlling the Diseases Spread by Seeds.** See above No. 162.

DISEASES OF VARIOUS CROPS.

242 – **A new Bacterial Disease of Western Wheat Grass (*Agropyron Smithii*).** — O' GARA, P. J., in *Science*, New Series, Vol. XLII, N. 1087, pp. 616-617. Lancaster, Pa., 1915.

The writer reports the presence of a very unusual type of bacterial disease occurring on "western wheat grass", *Agropyron Smithii* Rydb. hitherto unnoticed in the Salt Lake Valley, Utah. The affected plants are usually somewhat dwarfed, the most striking characteristic of the disease being the presence of enormous masses of surface bacteria which form a lemon-yellow ooze or slime on the aerial parts of this plant. Sometimes this bacterial slime appears in small droplets, spreading over the sheath, upper nternode and inflorescence. The glumes which are badly attacked reveal bacterial layers of slime between them and the floral spikelets, while the disease does not attack the roots, lower internodes and sheaths. There is produced a premature drying and bleaching of all the parts of the plant covered by the bacterial ooze. This disease has many characteristics in common with RÁTHAY'S disease of orchard grass (*Dactylis glomerata* L.) caused by *Aplanobacter Ráthayi* E. L. S., and described by RÁTHAY and later by SMITH.

The writer has in progress an extended study of the disease and of the causative organism.

243 – ***Ustilago Arrhenatheri* (= *U. dura?*) on French Rye Grass (*Arrhenatherum elatius*).** — SCHELLENBERG, H. C., in *Berichte der deutschen botanischen Gesellschaft*, 33 Year, Vol. 33, N. 7, pp. 316-323. Berlin, 1915.

While studying some diseased specimens of French Rye Grass (*Arrhenatherum elatius*), the writer noticed upon them two species of *Ustilago*: *U. perennans*, a well known fungus described by ROSTRUP, and another species entirely distinct from the first, which he calls *U. Arrhenatheri*.

The spores of this *Ustilago* are enclosed in the grains; the glumes are well divided and white. Taking hold of the spores with the fingers a marked resistance is noticed. The spores measure from 5 to 8 μ; their exterior surface is smooth. *U. Arrhenatheri*, damages the flowers less than *U. perennans*, but it makes no distinction between the flowers completely developed and those that are not. In the diseased flowers the glumes and spikes are smaller.

The colour of the spores is slightly darker than that of the spores of *U. perennans* ; the spores are often stuck together.

In the spore germination *U. Arrhenatheri* may be distinguished from *U. perennans* principally by the fact that its promycelium does not form sporidia.

*U. Arrhenatheri* is probably identical with *U. dura* described in 1906 by APPEL and GASSNER.

244 - ***Pleosphaerulina* sp. a new Alfalfa Leaf-spot in America.** — MELCHERS, LEO E., in *Science*, New series, Vol. XLII, No. 1085, pp. 536-537. Lancaster, Pa., 1915.

In October, 1914, the writer's attention was attracted by the appearance of an alfalfa field in the vicinity of Manhattan, Kansas. Careful investigation showed that a leaf-spot was prevalent on many plants and that it was strikingly different from anything with which the writer was familiar.

The plants affected might be distinguished by the sparseness of the leaves, their unthrifty appearance and the presence of the characteristic leaf-spot.

The disease was again located in the aforementioned field on April 17, 1915, and in a number of fields belonging to the Kansas Agricultural College. Specimens were also collected in different localities in Kansas and in other States.

The study of the material collected leaves no doubt as to its pathogenicity. The fungus is an ascomycete belonging to the genus *Pleosphaerulina*, which has not as yet been reported in North America. Inoculation experiments are now under way.

The data are not as yet sufficient to identify this fungus with *Pl. Briosiana* Pollacci which is the cause of an alfalfa leaf-spot in Italy, Austria and Brazil. The spots are confined almost exclusively to the leaves, frequently causing spots along the margins, but the fungus sometimes attacks the petioles also.

This disease, which causes the destruction of the foliage, may prove to be of considerable economic importance.

245 - **Researches on the Germination of the Late Blight of Potato *(Phytophthora infestans)*** (1). — MELHUS, I. E., in *Agricultural Experiment Station of the University of Wisconsin, Research Bulletin* No. 37, pp. 1-64, Figs. 1-8. Madison, Wisconsin, 1915.

The conidia of *Phytophthora infestans* may germinate either indirectly by the production of zöospores or directly by germ tubes. The type of germination is determined chiefly by external influences, such as temperature, moisture, and the medium in which the conidia are placed.

Temperatures below 20° C. have been found more favorable for zoospore germination in water, in which case the minimum lies between 2 and 3° C., the maximum between 24 and 25° C.; the optimum between 12 and 13° C.

For direct germination the limits are all higher; it was very scanty below 15° C.; the minimum is between 10 and 13° C.; the maximum very near 30° and the optimum about 24° C.

(1) See *B.* Jan. 1916, N. 119-120. (*Ed.*).

Indirect germination occurs generally in a 10 per cent dextrose solution, sparingly in a 16 per cent solution, and not at all in a 20 per cent solution. Indirect germination is replaced by some direct germination in the last mentioned strength. The time required for the spores of *Ph. infestans* to germinate is usually from one to three hours. The shortest period for indirect germination was 45 minutes. Direct or tube germination is a slower process and also is dependent upon the temperature. Eighty per cent of the conidia germinated at temperatures between 10 and 13° C., at either higher or lower temperatures the percentage decreased. Intermittent temperatures, changing from high to low, or vice-versa, do not particularly favor germination.

The period of motility of the zöospores was also influenced by temperature. Its duration varied inversely with the temperature, ranging from 22 hours at 5-6° C. to 19 minutes at 24-25° C. The further development of the zöospore after coming to rest, *i. e.*, growth of germ tubes, is more rapid at 24-25° C. than at lower temperature.

A frost that kills the tissues of the host plant is also sufficient to kill the conidia of *Phytophthora*. Leaf juices resulting from the softening of infected tissues have an inhibiting effect on germination. Light, either direct or diffuse, does not hinder germination so long as the temperature is not above the optimum.

Indirect germination takes place in the morning dew and rain on potato foliage under field conditions. Increasing the amount of nascent oxygen in the medium containing the conidia does not stimulate germination, but on the contrary inhibits it. It may be that sufficient oxygen exists in the conidia to allow indirect germination to take place.

The writer has also carried out studies on the toxicity of certain salts and fungicides. When the conidia were subjected to optimum temperature conditions for indirect germination, 0.0159 per cent of copper was necessary to prevent germination.

In these conditions, copper acetate, copper nitrate or cupric chloride produce the same effect, while cuprammonium sulphate is about eight times as toxic as the other copper salts tested.

Calcium polysulphide (1 : 21.7) and sodium and potassium polysulphides at one per cent prevent germination.

The conidia of *Plasmopara viticola* were slightly more resistant to the polysulphides than those of *Phytophthora*.

The most favorable temperature for the growth of the mycelium in the tissue is about the same as the optimum for direct germination in water, 24° C. Infection may take place through either the upper or lower surface of the leaf.

Generally the lower surface of the leaf is most susceptible, this is attributed to the difference in the number of stomata which are 200 to 400 times more numerous than on the upper surface.

A rich bibliography follows.

246 - ***Spongospora subterranea*** **("Powdery Scab of Potatoes") in Oregon.** — BAILEY, F. D., in *Science*, New series, Vol. XLII, No. 1082, pp. 424-425. Lancaster, Pa., 1915.

The *Spongospora subterranea* scab disease of potatoes has recently been reported in Tillamook County, Oregon. It seems to be the first time this disease has been noticed west of the Rocky Mountains (1).

The infected tubers, examined and identified by the writer in April were raised on a farm in the coast district of Oregon referred to above. The seed of this variety had been introduced from twelve to fifteen years ago, and new seed had not been introduced since that time.

One specimen was picked up in a grocery store at Tillamook.

The fact that the district is isolated and that potatoes are not raised in sufficient quantity for export possibly has been a natural means of preventing a more general dissemination of the disease.

247 - ***Pestalozzia Palmarum,*** **Injurious to the "Cinnamon Tree" *(Cinnamomum zeylanicum)* in the Federated Malay States.** — SHARPLES, A., in *The Agricultural Bulletin of the Federated Malay States*, Vol. III, N. 9, p. 381. Singapore, 1916.

Individual bushes of *Cinnamomum zeylanicum* growing in the Experimental Gardens at Kuala Lumpur have been attacked by a disease whose first symptom is the death of one of the branches. The rest of the bush appears healthy but ultimately other branches begin to die off. The leaves wilt but remain attached. An affected branch shows the whole cortex to be diseased. This diseased cortex is dark-brown in colour. Sections through this diseased cortex showed the presence of a fungus — *Pestalozzia Palmarum* — a common parasite on the coconut palm but dangerous to the coconut only when the trees are growing under unfavourable conditions. The fruit-bodies of the fungus are embedded in the rotting tissues of the cortex and when the cortex is completely disintegrated the spores are liberated and provide fresh means of infection.

The tree may ultimately die, but the attacks of this fungus, in the case also of the Coconut, can usually be controlled. The most effective method of preventing the spread of the fungus is to cut off the diseased branches well below the affected parts and burn them immediately. *Pestalozzia Palmarum* is reported from Ceylon as attacking the leaves of Cinnamon bushes, causing what is termed « Grey blight ».

248 - ***Alternaria Panax*** **the Cause of a Root-rot of Ginseng *(Panax quinquefolium).*** — ROSENBAUM, J. and ZINNSMEISTER, C. L., in *Journal of Agricultural Research*, Vol. V., N. 4, pp. 182-183, Pl. XII-XIII. Washington, D. C., 1915.

While working with diseases of Ginseng (*Panax quinquefolium*) during the summer of 1913, the authors obtained from a garden near Cleveland, Ohio, roots which showed a peculiar dry-rotted condition about the crown.

The dark-brown centre of the lesion was more or less sunken and firm to the touch and gradually shaded into the yellowish white colour of the healthy root. This form of dry-rot is distinguished from others by its

(1) Since the above was written this disease was noticed on potatoes in British Columbia. (*N. of A.*

lack of odour and the fact that the rotted roots never become soft. When the rot is near the crown of the root, the top of the plant often shows signs of disease. These signs are a wilting and yellowing of the leaves, which readily drop off on being disturbed. Such conditions may, however, be caused by other root rots attacking ginseng, as, for example, the rot caused by *Phytophthora Cactorum*.

In numerous isolations made from these lesions, an *Alternaria*-like fungus closely resembling *Alternaria Panax* Whet. was secured, in all cases, in pure culture. In order to determine whether these two fungi were identical, a series of inoculations on roots and tops were made with both cultures. In addition, a study was made of their macroscopic and microscopic appearance.

Inoculations were made with the *Alternaria*-like fungus and with *Alternaria Panax* not only on portions of tops and roots, but also directly in the soil on roots to which the tops were still attached. In all cases the results were definite and with identical effects : rotting of the roots, and appearance of the typical leaf-spots on the leaf margin. The two fungi under consideration are therefore identical and, contrary to what has been heretofore supposed, *A. Panax* is able to cause a root-rot.

The study of this disease leads to the conclusion that the best preventive means are :

1) care in transplanting so as to injure the roots as little as possible, as roots having the cortex and epidermis intact are not susceptible to infection.

2) the removal and burning of all diseased tops and stems in the autumn.

249 – **On a Fungoid Disease of the Fruit-bearing Branches of the Raspberry in Switzerland.** — Osterwalder, A., in *Schweizerische Obst- und Gartenbau-Zeitung*, No. 20, pp. 278-279, 1 Fig. Münsingen, 1915.

In several parts of Switzerland complaints have arisen about a disease attacking raspberry plants in the spring ; some of the fruit-bearing branches do not bud, or if they do they, produce scanty shoots and discoloured leaves. Close to the root system, the diseased branches seem flattened and an appearance of having been choked, the tissues thereof are dead or so diseased as not to allow the water to pass properly from the roots to the budding tops. In summer, at the time the fruit ripens, spots are seen on the stems, which afterwards spread and penetrate causing the epidermis to fall off in the autumn. Under the epidermis, however, the writer found that the dark spots remain, being due to the presence of a thick mycelium which causes the fall of the epithelial tissues. This mycelium continues to develop, conditions being favourable, also in the winter and spring, and causes the deformation and mischief already mentioned.

The specific agent of the disease seems to be either *Diplodina pallor* according to E. Macherauch or *Hendersonia Rubi* according to F. Krause. The writer has noticed, under the epiderm of the diseased portions, red-brown fructifications containing a few spores of *Fusicladium* but the large

majority of the spores belonged to an unidentified species of *Cladosporium* to which the writer believes this disease may be attributed.

Experiments are being carried out to obtain pure cultures and to test artificial infection. As means of prevention, the treatment proposed is in summer and autumn the application of ferrous sulphate; of sulpho-calcium mixture; or even of carbolineum.

The research for immune varieties does not seem hopeful; all varieties known in Switzerland are more or less infected by this disease. The least susceptible seems to be the " Baumforths-Sämling " variety.

250 - **Researches on Vine Mildew. Favourable Time for Treatment.** — RAVAZ, L. and VERGE, G., in *Annales de l'Ecole Nationale d'Agriculture de Montpellier*, New series Vol. XIV, Part III, pp. 169-199, Figs. 1-18. Montpellier, 1915.

These researches, which were carried out at Montpellier by the writers from 1910 to 1913, concern the germination of the winter spores, the period their germinating faculty lasts, the proper time for treatment, etc. The conclusions were the following:

1) Summer and autumn conidia do not seem to remain alive on or in the soil during winter. They generally disappear, either because they rot, or because insects destroy them.

The first infection is however due to the macroconidia, derived from the winter spores, which are scattered on the surface of the ground.

2) The appearance of these macroconidia is equivalent to the appearance of the white spots on the herbaceous organs; it may therefore be considered as the first stage of invasion, which develops, not on the vine, but elsewhere.

3) If the zöospores of the macroconidia are carried to vines whose vegetation is sufficiently advanced, they cause the initial infection, from which will be derived the second stage of invasion; but if the vine has not yet budded they die without producing the disease, which may then not manifest itself owing to the insufficiency of germs. This is the case with late vines.

4) To be effective, cupric treatments should cover all the parts to be protected at the time when the macroconidia make their appearance, that is, at the time of the invasions. In 1915 the advent of the conidia was announced 5 or 6 days in advance by the "oil spots," a sufficient length of time for the spraying of all the vines. If this were always the case, the disease itself would indicate the exact time for the treatment.

However, the oil spots are often wanting, and it is there that the disease is most serious. In this case the advent of the conidia may be announced by:

1) The conidia themselves. It is then only necessary to produce round the suspected stocks the conditions of temperature and of moisture most favourable to their appearance. This is done by covering some of the stocks with a bell and keeping the inside very damp. The appearance of the conidiophora is here the announcement of an approaching invasion from without and the treatment should be applied. These researches should of course be only made on stocks which have not yet been treated.

2) The announcement may be given even sooner by the existence of the germs, *i. e.* the zöospores, which stimulate it. The existence of the soil germs may be ascertained by a microscopic examination of the leaves bearing winter spores which are in the vineyard, and of those from outside (carried by rain or wind). These should not be collected on panes of glass, but in a wide funnel placed over a decanter, where the conidia and the drops of rain and dew will accumulate together. If in such conditions these conidia germinate, which is easily seen, they germinate on the leaves and a new invasion is on its way. The treatment should then be applied.

It is for warning Stations and intelligent proprietors to give these directions, which need attention only in seasons of rain and of heavy dews. Following along parallel lines these two methods, the second especially, the writers will endeavour to anticipate the invasions and to indicate sufficiently far in advance the favourable moment for applying the treatment.

251 - ***Pinus rigida* and *P. arizonica*, New Hosts for *Peridermium pyriforme* in the United States of America.** — HEDGCOCK, GEORGE GRANT and LONG, WILLIAM H., in *Journal of Agricultural Research*, Vol. V, N. 7, pp. 289-290, Pl. XXVIII. Washington, D. C., 1915.

*Peridermium pyriforme*, which is the aecial form of *Cronartium pyriforme* (Peck) Hedgc. and Long, was collected by HEDGCOCK for the first time on *Pinus rigida* Mill., on June 16, 1915, near Essex Junction, Vt.

HEDGCOCK had previously found the uredinial and telial forms in abundance in the same locality on *Comandra umbellata* (L.) Nutt. (1) on July 31, 1913.

This find is important, since it may serve to clear up the mystery associated with the identity of the host in the case of the type specimen on *Pinus* spp., collected by J. B. ELLIS in 1880, possibly near Newfield, N. J., ELLIS not being certain as to the locality. Since the telial form was collected by ELLIS near Newfield in 1879 and as *Pinus rigida* is the only native species of pine in this locality known to be attacked by the fungus, it is very probable that this species is the host of the type.

Mr ROY G. PIERCE collected a number of specimens of *Per. pyriforme* on *P. divaricata* (Ait.) Du Mont de Cours, in several localities near Cass Lake, Minn., during the month of June 1915. So far as the writers know, only one specimen of the fungus has hitherto been reported on *P. divaricata* by J. J. DAVIS in Douglas County, Wis. PIERCE has also founded the uredinial form, *Cronartium pyriforme*, in July 1915, on *C. umbellata* in the same locality where he had collected *Per. pyriforme*.

LONG also has a specimen of this rust on *P. divaricata* collected at Roscommon, Mich. This specimen was sent in with *Per. cerebrum* which on this host produces typical globular swellings, while *Per. pyriforme* causes the typical fusiform swellings.

LONG has, however, recently received a specimen of *Per. pyriforme* on

(1) See *B.* Jan. 1916, N. 126. (*Ed.*).

*Pinus* (*Murrayana*) *contorta* Loud. collected at Roscommon, Mich. which produced a globoid gall which was 6 cm in circumference and 2 cm in diameter.

In June 1915, LONG received a fine specimen of *Per. pyriforme* taken on *P. arizonica* Engelm. in Jacobson's Canyon, Crook National Forest, Arizona. This is the first time this rust has been reported on this host.

*Peridermium pyriforme* causes three forms of disease on pines : a) with slight or no hypertrophy, common on *P. divaricata*, *P. pungens* Michx. and *P. ponderosa scopulorum* Engelm. ; *b*) causing a fusiform swelling, on *P. arizonica*, *P.* (*murrayana*) *contorta*, *P. divaricata*, *P. ponderosa* Laws., *P. ponderosa scopulorum*, *P. rigida ;* c) causing the formation of globose galls, on *P.* (*murrayana*) *contorta*. *Per. pyriforme*, especially when weathered, superficially resembles *Per. Comptoniae* with which HEDGCOCK found it associated near Essex Junction, Vt., where he found one specimen of the former and nearly fifty of the latter species.

A more careful search for *Per. pyriforme* will greatly extend the known range of the disease of pines caused by it ; it is probable that up to the present it may have been mistaken by collectors for *Per. Comptoniae* which it much resembles.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS

GENERALITIES

252 – **Insects Injurious to Cereals, Leguminous Plants and other Stored Grains in Mauritius.** — D'EMMEREZ DE CHARMOY, D., in *Department of Agriculture, Mauritius, Scientific Series, Bulletin* N. 2, 16 pp., 3 Plates, Mauritius, 1915.

A list of several insects, followed by morphological and biological illustrative notes, and information on the nature and importance of the damage caused, besides giving the preventive means in common use.

*Calandra oryzae*, the "rice weevil", attacks rice, maize and wheat ; the larvae penetrate into the grains, rapidly reducing them to dust.

*Didonerus minutus*, the "maize beetle" or "bamboo borer", has been recorded in Guadeloupe, in Java and in India as extremely destructive to bamboo. In Réunion, in Brazil and in Tahiti, it attacks various plants. In Mauritius it also causes much damage to maize kept in cobs. The eggs are laid into a tunnel bored into the grain by the female ; the larvae hatch and devour the grain.

The writer reports also an hitherto unidentified microlepidopteron, the maize tineid, which attacks that cereal.

*Ephestia cahiritella*, the "rice moth", has in Mauritius a preference for white Saigon and Rangoon rices. Other kinds of rice are seldom attacked. These insects are not injurious on account of the quantity of grain they consume but specially on account of the unsaleable state to which they reduce the grains, as they leave in them their excreta and their nymphal envelopes together with the spun-up grain, thus rendering them unsaleable. In India it attacks especially rice and flour. In Egypt and in America, where it has been named the "dried-currant moth", it attacks most of the dried

fruits, such as raisins, currants, and figs. It also attacks almonds, nuts, and cacao-beans.

*Bruchus obtectus*, the "bean weevil", *B. chinensis*, the "cowpea weevil", and *B. quadrimaculatus*, the "four spotted weevil", are continually imported from India, with gram and different varieties of peas, and have rapidly spread in Mauritius where they cause damage to several leguminous plants (*Cicer arietinum, Phaseolus vulgaris, Pisum sativum, Vigna Catiang, Cajanus indicus*). The newly hatched larva eats its way immediately into the interior of the pod and attacks the seeds which it eats partially and then forms the chrysalis.

*Sylvanus signatus* and *S. surinamensis*, the "saw-toothed grain beetles", and *Tribolium ferrugineum*, the "flour beetle", attack indiscriminately all sorts of grains as well as bran flour and other foodstuffs.

253 - **Pests and Diseases on Cultivated Plants in the Dutch East Indies in 1914.** — RUTGERS, A. A. L., in *Mededeelingen van het Laboratorium voor Plantenziekten*, N. 15, 45 pp. Batavia, 1915.

The writer gives information on some pests and diseases which have appeared during 1914 in the Dutch East Indies. That year was characterized by a prolonged drought, therefore no serious fungoid diseases were noticed. Other insects, however, caused more or less important damages : *Acridium* sp., on different plants ; *Lecanium viride* on coffee ; *Helopeltis* on tea plants and cacaos. The drought caused the loss of 75.000 "bouw" (13 125 acres) of rice, an area larger than the average.

The decree regarding the importation of fresh fruit from Australia, for preventing the introduction of the "fruit fly" (*Ceratitis capitata*) took effect on February 1st 1914.

Among the diseases and pests reported for the first time in the Dutch East Indies in 1914, the writer mentions : a rice disease caused by *Tilletia horrida* Takahashi (1), which has not as yet caused any serious damage.

A disease of the oil palm (*Elaeis* sp.) which shows a rotting of the leaves in the core of the young trees. The cause is not known. The damage is of slight importance.

*Melissoblaptes rufovenalis* Snellen (2) nibbles the flowers and young fruit of the coco nut trees. The damage is serious but has for the present been circumscribed.

In the two last chapters the writer gives a summary of the reports received from professors of agriculture and other officials on the diseases observed on different cultivated plants and also a list of 38 phytopathological publications concerning the East Indies printed in 1914.

INSECTS INJURIOUS TO VARIOUS CROPS

254 - ***Crioceris melanopa (Lema melanopus)* Injurious to Oats and Barley in Hungary.** — KADOCSA, GY., in *Kisérletugyi Közlemények*, Vol. XVIII, Part I, pp. 108-176, Pl. I-VIII. Budapest, 1915.

The writer first describes minutely the appearance and rapid multiplication of *Crioceris melanopa* (*Lema melanopus*) in Hungary. In 1831,

(1) See *B.* Oct. 1914, N. 971.
(2) See *B.* Nov. 1914, N. 1235. (*Ed.*)

STAUT signalled for the first time the larva of an insect which devastated, in the spring, whole fields of oats and barley. This larva, which he called a " slug ", which is the name given to it by Hungarian peasants, must be identical with *Cr. melanopa*. Since then *Crioceris* made frequent appearances causing excessive damage. In 1883, the Entomological Station received for the first time some larvae which had been destroying the barley fields in the district of Zemplén. In the same year the insect was also seen in the district of Szilágy. From 1883 to 1888, however, only sporadic appearances occurred, and it was not until 1889 that it commenced to spread rapidly on a larger scale. That same year 12 districts were infested. In 1890 the spread was still greater and the insect attacked not only barley but even rye. The worst ravages took place in 1891, when 23 districts were invaded. The damage caused that year was valued for the entire country between 1 and 1 1/4 million pounds. The writer has drawn up a statistical list of all the districts periodically invaded from 1831 to 1914; the total number was 47. In order to free the infested regions as promptly as possible, the Entomological Station undertook an extensive series of experiments. The means of destruction tested were: " thanaton ", extract of pyrethrum, and arsenate of copper. The extract of pyrethrum (2.5 %), applied in large quantities killed 75 % of the larvae, but its high price did not allow of its being used on too extensive areas. Arsenate of copper gave negative results. " Thanaton ", on the contrary, gave excellent results in a 2 % aqueous solution when its percentage of nicotine was not too much below 4.5 %.

The writer describes the life cycle of *L. melanopus* and enumerates its natural enemies, together with the preventive means employed hilherto. He draws the following conclusions: *L. melanopus* was known in Hungary as a dangerous pest to agriculture as early as the beginning of last century. It caused immense havoc at the beginning of 1890 and during the closing years of last century. Although in Hungary this insect inhabits the plains, it may also be found in mountainous regions, and where the climate and soil are favourable to the cultivation of barley and oats.

The appearance of *L. melanopus* in swarms is periodical. Through a succession of years the infested zones become increasingly extensive and the damage reach es a maximum, after which it diminishes.

The writer believes that the periodical disappearance of the pest is due to its natural enemies.

*L. melanopus* is known also in other countries but it seems to be only really dangerous to agriculture in Austria, Roumenia and above all in Russia.

The advent of the insect depends on the early or late arrival of the spring. In normal conditions, the first insects begin to appear in the first half of April. They collect in large quantities on the young crops and nibble and perforate the barley and oat leaves tracing lines of varying length. About two weeks after the arrival of the insect, numerous eggs may be found. The mucus covered larvae hatched from the eggs lie in the middle vein of the leaf like strings of beads, they suck the leaves but do not per-

forate them as the adult insect does; and they leave the skeleton and the epiderm of the under surface of the leaf. The nibbling of the insect causes a blanching of the leaves. The infected places show in patches where the crops are most luxuriant. In about four weeks the larvae are entirely developed and descend to the ground to complete their metamorphosis which takes about another two weeks. *L. melanopus* has only one generation in the year.

Besides *L. melanopus* also *L. lichenis* is known in Hungary as an injurious insect, but is more rare.

The measures against *L. melanopus* consist in the capture of the insects in the spring and the spraying of the infested patches. The most satisfactory means of prevention among those tried by the writer are: nicotine sulphate, " thanaton ", and chloride of barium (4 % solution). The two first give the best results when the nicotine content is from ·4 oz. to ·5 oz. per gallon of water. To ensure the adhesion of the chloride of barium, molasses may be added in the proportion of 4 %. Of these three remedies, the last has been the least satisfactory.

255 – ***Heteronix piceus* an Insect Pest of Lucerne, in Australia.** — FRENCH, C. Jun., in *The Journal of the Department of Agriculture of Victoria*, Vol. XIII, Part 9, pp. 567-569, 3 Figs. Melbourne, 1915.

During the last few months many lucerne-growers at Werribee have suffered considerable losses by the depredations of insect pests. Close to each dying plant, 1 or 2 inches below the surface, numbers of Cockchafer Grubs (*Heteronix piceus*, Blach.) were found. In one spadeful of earth, nearly two dozen grubs were observed. The surface of the ground, where the grubs were plentiful, was perforated with thousands of holes, nearly all containing the insects.

The grubs live on the roots of native and other grasses. They seem to confine themselves to particular patches of the soil, usually where manure has been rather plentifully used. When a lucerne crop is badly affected with these grubs it is advisable to have it cross scarified, if practicable, harrowed and then rolled. A small lucerne patch growing at the Research Farm at Werribee was attacked by the grubs. The above-named methods were used and the results were very satisfactory; the plants are now throwing out new foliage. Reports have recently come to hand of the grubs attaching wheat. The trouble is generally in patches. They eat out a small space and then start on another one. They feed on the roots of plants and sometimes come up and destroy the foliage when the crops are a few inches or so in height.

As a remedy, the A. suggests cutting up lucerne, grasses, succulent weeds etc., into small pieces, and dipping them into arsenate of lead (1 lb. to 20 gallons of water). These poisoned baits could then be spread over the affected area.

256 - ***Apamea testacea* Injurious to Forage Plants in Sweden and Denmark.** — WITTE, HERNFRID, in *Sveriges Utsädesforenings Tidskrift*, Year XXV, Part 5, pp. 249-251, Figs. 1-4. Malmö, 1915.

In 1915, *Apamea testacea* Hübn. ("Gräsrostflyet") caused much damage to forage plants at Svalöf. The larvae nibbled the roots and the lower part of the tops of *Festuca pratensis* L., *Phleum pratense* L. and *Dactylis glomerata* L. The writer found larvae of this insect in a field of *Festuca* near the Station of N. Wrams (Skäne).

*A. testacea* was reported at the same time in Denmark in the following localities : at Stevns, on *Dactylis glomerata ;* at Roskilde, on *Festuca ;* at Lungby and Assens, on *Avena.* The infected fields should be dug up and for some years should not be sown to the above named grasses.

257 - ***Eurydema oleracea*, Injurious to Several Plants in Sweden.** — KEMNER, N. A., in *Meddelande från Centralanstalten för försöksväsendet pä Jordbruksområdet, Entomologiska Avdelningen*, N. 23, pp. 1-14, Figs. 1-5. Stocholm, 1915.

*Eurydema oleracea* L. ("Rapssugaren") has in recent years caused a good deal of mischief in several localities in Sweden. It attacks more especially cabbages and turnips, and less frequently cereals and potatoes. Among garden plants it is injurious to *Matthiola annua* and *Hesperis.* The insect was considered injurious by Linnaeus in 1760, but since that time *Eurydema* has almost entirely disappeared, and only in recent years has begun once more to breed and spread with unusual rapidity. In order of time, it was reported in 1913, at Kalmar, Scarab, Söderm. ; in 1914, at Kalmar, Östergötland, Bohus, Sihlms, Upsala, Söderm., Värml., Norrb. ; in 1915, at Gotland, Kalmar, Jönköpings, Ostergötl., Skaraborg, Söderm., Örebro, Bohus, Värmland, and Västernorrl. It seems therefore, that the insect finds the conditions most favourable to it in the north. It has never been reported as injurious in Denmark and in Germany. In the adult stage, it hibernates in the vegetable residues of the previous year, and in May the eggs hatch. The larvae emerge in about a month, and the complete development is attained in August and September, when the most serious havoc occurs.

As means of prevention the following are advisable :

1) in autumn : remove to as great a distance from the fields as possible all dry leaves and refuse, etc. where *Eurydema* hibernates ;

2) use a 4 % petroleum emulsion to kill the parasite in a few minutes ; this must be done with care as it might hurt the more tender parts of the plant. The best results are obtained by two weak solutions applied successively at an interval of 3 to 10 minutes.

It is remarkable that this *Eurydema* prefers to keep to the periphery of the land in cultivation, thus the preventive measures are rendered much easier.

258 - ***Leucopholis rorida* in Manioc Plantations.** — LEEFMANS, S., in *Mededeelingen van het Laboratorium voor Plantenziekten*, N. 13, Fig. Buitenzorg, 1915.

About eight years ago *Manihot utilissima* began to be cultivated on the slopes of the Kloet in the east of Java. Shortly after a Coleopter made its appearances in the plantations and was found impossible to eradicate.

The insect was identified two years ago as *Leucopholis rorida* L. and was found to be spreading rapidly. This is the most injurious of the Coleoptera attacking the roots of *Manihot utilissima*. The manioc plantations offer the most unfavourable conditions for a campaign against this insect for several reasons : the lengthy time the plant remains in the soil, the inability to alternate with other crops and the superficial working of the soil. The life cycle of *Leucopholis rorida* was very carefully studied. Swarming takes place in October, November and December. The numbers then greatly diminish. Three or four weeks later the eggs are laid at a considerable depth beneath the surface. When the larvae are about three months old the damage to the plants becomes evident by the withering of the leaves. The adult larvae being at a depth of at least 10 inches it is impossible to work the soil so as to bring them to the surface. They there pass through a resting period varying from one to four weeks in length and then shut themselves into a sort of cell. On emerging from this cell the insects pass through another rest period of several weeks before taking flight. One generation requires a whole year for its completion. The writer has identified as a natural enemy of the larva a digger-wasp of the family *Scoliidae*, genus *Dieles*. The female wasp searches in the earth for the larva and paralyses it with a sting in the oesophageal ganglion, then lays its egs in the larva. Three or four days after, a larva hatches which attacks that of the Coleopter. The time required for a generation of these wasps is from one to two months; 26 per cent of the Coleopter larvae contained these parasites. This, however, is not sufficient to destroy the pest. The natives capture the beetle by means of the crushed fruit of *Capsicum annuum* L. ("Lombok") which gives out a peculiar smell; but this method has little effect and is very expensive. Other methods tried by the writer were either too expensive or too difficult to carry out.

Experiments on infecting the larva with a fungus are in course ; the results that have been obtained in the laboratory appear to be satisfactory, Other trials will be made in the open. Stomach poisons cannot be used; carbon disulphide is the best material. Two doses of 20 c.c. injected into the soil at intervals of 3 ft. × 3 ft. to a depth of 10 inches seem to be sufficient. But this method is too costly to be applied on a large scale, the expense amounting to £5.12 *s.* per "bouw" (1 ¼ acres). Perhaps at the beginning of the infection a treatment of the infested soil with carbon disulphide might be beneficial. Other preventive measures are digging up the soil and collecting the larvae and substituting the cultivation of sisal for that of manioc in the places most infected. The writer also describes the life cycle of other Coleoptera (*Lepidiota, Euchlora, Anomala* spp.) which he has noticed on *Manihot*, but are not as injurious to it as *Leucopholis*.

259 – **Species of *Hyponomeuta*, Injurious to *Lonicera* and *Prunus* in Sweden.** — Tullgren, Alb., in *Meddelande från Centralanstalten för försöksväsendet på Jordbruksområdet, Entomologiska Avdelningen*, N. 21, pp. 1-23, Figs. 1-16. Stockholm, 1915.

Description and biological notes.

*H. evonymellus* L. is the species most widely distributed in Sweden,

where it has appeared in recent years on *Prunus padus* in such numbers as to cause very serious havoc. *H. malinellus* Zell., *H. padellus* L., *H. cognatellus* Hb. are more rare and never very injurious. The geographical distribution of the species reported until now, is the following :

*H. evonymellus* at Malmöhus, Kristianstad, Blekinge, Halland, Kalmar, Älvsborg, Skaraborg, Östergötland, Sörmland, Örebro, Stockholm, Upsala, Västmanland, Bohus, Värmland, Kopparberg and Gävleborg.

*H. cognatellus*, in the district of Skåne, Blekinge, Västergötland, Ostergötland and Uppland.

*H. malinellus* at Skåne and Västergötland.

*H. padellus* at Skåne, Blekinge, Småland and Västergötland.

Carbolineum and arsenate of lead, have given good results as preventives. The carbolineum is applied in the form of an 8 per cent. emulsion in the spring just before the budding begins ; later, when the larvae appear they are killed by spraying with a solution of arsenate of lead.

260 - ***Pulvinaria vitis* in Uruguay.** — SCHURMANN, G., in *Revista de la Asociación rural del Uruguay*, Year XLIV, No. 8, pp. 481-483, 1 Fig. Montevideo, 1915.

The writer reports (it is believed for the first time) the appearance in November 1914, of *Pulvinaria vitis* ("cochinilla colorada de la viña") in Uruguay, where it causes serious damage in the vineyards. Information is given on the morphology and biology of the scale and on the means of prevention, which are similar to those already in use in other countries.

261 - ***Hylobius abietis* and Methods of Control, from Observations Made in 1913-14 in the Province of Orel, Russia.** — SIMONE, F. P., in *Liesnoj Journal* (The Forest Review), Year XLV, Part 6-7, pp. 1080-1085. Petrograd, 1915.

*Hylobius abietis* is one of the insects most injurious to sylviculture. As a preventive measure, the uprooting of the stocks is advisable and gives good results in several ways, but economical reasons render it necessary to find less expensive methods. The writer has conducted with this aim the following experiments.

On September 9th 1913, he collected from eight stocks 384 larvae of the insect, which were under the bark, above and below the collar, and partly also on the roots to a depth of 14-16 inches. On the upper part of the stocks the larvae were small ; those on the roots were of the largest size.

On the 7th and 8th October, the researches were carried out over an area of 556 acres. In this case also the bark of the stocks and roots was removed until, on the latter, no more larvae were found. In two days 492 stocks were barked and 10272 larvae collected.

On October 9th, the same work was carried out on an adjoining section of the forest ; during the winter, before cutting the trees, the bark was removed from the lower part of the trunk down to the collar, so that the stocks were covered with snow through the winter and were sufficiently dry in the spring. In this section only 1239 larvae were collected, while the number of stocks was about the same as in the previous one, *i. e.* 481, of which 98 had not been barked. While collecting the larvae it was noticed that they were found only on the unbarked stocks. Had the in-

sect laid its eggs with equal abundance in the two sections under observation, then, in the second section, only from the unbarked stocks, the number of larvae collected ought to have been almost double what it really was. But it is obvious that the strong smell of the unbarked stocks in the adjoining section attracted the insects more than the 98 unbarked stocks scattered among the others that were barked and already dry.

A new means of control of *Hylobius abietis* and one easy of application, is thus suggested. In the sale contracts of the pines, a clause should be included which renders obligatory the preventive barking of the stocks above and below the collar before the trees are cut down. The operation is not costly: according to the data given by the writer the expense would amount to a farthing per tree, *i. e.* between 1s. 9d. and 2s. 7d. per acre.

262 – **The Zimmerman Pine Moth.** — BRUNNER, J., in *U. S. Department of Agriculture, Bulletin* No. 295, pp. 1-11, Pl. I-XI. Washington, 1915.

One of the insects of the order Lepidoptera very destructive to coniferous trees, and especially to yellow pine (*Pinus ponderosa*) in various sections of the West, to white pine (*Pinus Strobus*), Canadian or Red Pine (*P. resinosa*), Austrian pine (*P. austriaca*), Scotch pine (*P. sylvestris*), Swiss pine (*P. Cembra*), and other pines in the East, is the Zimmermann pine moth (*Pinipestis zimmermani* Grote). Apart from being largely the cause of "spiketop" in mature timber, it spike-tops, stunts, and kills innumerable trees of the so called "second growth". It is obvious that the killing of many trees in stands preferred by the moth results in too great a thinning out of the stand. This wastage of ground is further augmented by the permanent stunting of a still greater number of trees by the insect's work, because the space taken up by such scrubs would just as readily accommodate thrifty, well-formed trees.

Moreover, the wood from trees that have been infested by the moth is invariably so permeated with pitch that the lumber cut from such logs is either materially reduced or is rendered wholly unfit for commercial use.

In the northern Rocky Mountain region, *Pissodes schwarzi* Hopk. is a common associate of the pine moth in yellow pine, if the trees are attacked near the base. It appears that there the moth takes as frequent advantage of the work of the beetle as the beetle does of the moth's. The result of infestation by either of them is exactly alike, although the latter's attack is by no means restricted to the base of trees, while the work of the beetle is rarely found more than 2 or 3 feet above ground.

*Sesia brunneri* Busck,, wherever it exists (at present known in Montana and southern Idaho), is frequently associated with *Pinipestis* in yellow and lodgepole pine.

In Montana and Idaho another species of *Pinipestis*, *P.cambricola* Dyar, is one of the most important factors in regard to the existence of *P. zimmermani* Grote. It infests during the latter part of June the cambium of the terminal branches of mature yellow pine and many of these wounds are subsequently reinfested by the latter year after year. The work of this insect is almost invariably the primary cause of the knobby growth on

branches in which the Zimmermann pine moths breed undisturbed and this moth must therefore be regarded as a provider of brood trees for the more destructive *Pinipestis zimmermani*.

In most sections of the Rocky Mountains the Rocky Mountains hair woodpecker (*Dryobates villosus monticola*) is unquestionably the most efficient natural force in restraining the Zimmerman pine moth. Thousands of trees are each year regularly infested by the moth in comparatively small areas, and this bird as regularly destroys almost all of the larvae in all of them during early winter.

But the woodpecker cannot molest the caterpillars of the pine moth which live under "spike-tops," and in knobby branches on certain mature trees and this is evidently the reason why its activities bear no permanent fruit.

The cocoon of a Pimplinid of a new genus and new species is frequently found in the tunnels of the pine moth in Montana and Idaho. In some localities this parasite kills as many as 80 per cent of the larvae of the moth in second growth trees. Another, somewhat larger parasite (*Ichneumon* n. sp.) is frequently found during winter in the chrysalids of the moth. The moth does not pass the winter in the pupal stage and chrysalids found at the time always contain the parasitic fly, which, like the pimplinid emerges during early spring. There seems to be justification for the conclusion that, without man taking a hand by eliminating the main propagating opportunities, no natural enemy of the moth will ever render it harmless. To end "spike-topping" in mature stands, and to eliminate damage in growing timber, or, at least reduce it to a negligible amount it is necessary to remove:

1) those trees which, below the spike, show branches with yellow needles;

2) those which are struck by lightning and remain green, as the moth usually breeds in great number along the lightning scars and

3) those which display knobby growth on branches, they being in many localities the most prolific source of replenishment of the moth.

## INJURIOUS VERTEBRATES.

263 – **Rabbits *(Lepus cuniculus)* Injurious to Forests, in Hungary.** — MATUSOVITZ, P., in *Erdészeti Lapok*, Year LIV, Parts XIX and XX, pp. 482-486. Budapest, 1915.

During the year 1915, such an invasion of *Lepus cuniculus* occurred in the Royal forest inspection zone of the district of Pozsony and of Nyitra, as to seriously threaten the forest lands and field-crops. Several proprietors have therefore found it necessary to appeal to the communal authorities to enforce strict measures against the alarming propagation of this pest.

264 – **Rat Plagues in the Bombay Presidency.** — MAIN, T. F., in *The Poona Agricultural College Magazine*, Vol. VII, N. 2, pp. 77-80. Poona, 1915.

These plagues occur periodically and no part of the Presidency escapes except perhaps the Kokan, where the rainfall is very heavy and hinders

very effectively the multiplication and emigration of these rodents. They were reported for the first time in 1874, since when they have reappeared several times, causing enormous damages. In October 1878, after the close of the monsoon they spread rapidly over the whole Deccan and Karnatak, destroying almost entirely the crops of cotton, wheat, *jowar* and garden crops. The plague reached its maximum in 1879, when the early crops were damaged just as badly as the late ones, and the grain as soon as sown was scratched up and eaten, even three times successively in many fields. After destroying the winter crops the number suddenly decreased in the month of December and by the end of March 1880 the rats had disappeared as unaccountably as they had come.

In 1892-93 a plague of rats was recorded. It originated in the eastern talukas of Belgaum, but did not attain such serious dimensions as in 1878-1880 owing to opportune rain and an enormous increase of red ticks, which are probably one of Nature's principal controlling agencies in preventing an excessive increase of rats.

In 1901-02 rats did enormous damage in Gujarat, Khandesh and parts of Deccan.

In 1914-15 after a heavy monsoon Khandesh crops suffered severely from rats.

The most successful methods of dealing with rat-plagues are : 1) to dig the rats out of their burrows : 2) to discharge sulphur fumes into the rat-holes by means of a flexible wire tube and pump. This latter method is the most effective.

265 – **The Canadian Muskrat *(Tiber zibethieus)* in Austria. Control by means of Traps.** — See this Bulletin, No. 215.

ALFREDO RUGGERI, *gerente responsabile*.

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

# INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (*Ed.*).

FIRST PART.

# ORIGINAL ARTICLES

## Entomophagous Insects and their Practical Employment in Agriculture

by

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After the striking success of *Novius cardinalis* against *Icerya purchasei*, attempts to obtain similar results against other species of injurious insects by means of their natural enemies, especially entomophagous insects, were redoubled in intensity. There ensued an active search in every portion of the globe for useful insects with the object of importing them in the hope that their contact with the injurious species would have beneficial results.

However, the results attendant on this recent trend of agricultural entomology have not by any means been conspicuously successful, and it is permissible to believe that the choice of the auxiliary species has not always been wisely made. It is not to be thought that the importation of entomophagous insects, simply because these latter, as such, do no direct damage to crops etc, is entirely without harmful effects.

It must be admitted that, in certain cases, the action of certain entomophagous insects, though such action be possible of an indirect nature, is not to be encouraged by those concerned with the protection of plants against disease. In other cases, entomophagous insects, either native or imported, may be practically useless, their activities being insufficient to limit the increase of the injurious species in the required degree. In these circumstances the agriculturist is likely to entertain false hopes, which, after the inevitable disappointment, will tend to lessen his confidence in a weapon which in certain cases has given brilliant results. Further, his scepticism will probably be extended to the men of science who have not made their choice with the necessary precaution.

In actuality, the conditions restricting this increase in numbers, to which every organic species tends in the measure of its fertility, and which maintain the organic world, species to species, in the necessary state of equilibrium, are not all of similar nature. Consequently, entomophagous insects are not actually the chief check on the excessive multiplication of all the insects they victimise.

If such were the case, the hunt for the particular insect preying upon each particular injurious species would certainly be justified, but if the factors limiting the harmful species, or at any rate the chief of such factors, are of another nature, it is useless to call to our aid the endophagous insects when such are not the check imposed by nature herself (1).

Apart from entomophagous insects, the factors adverse to species injurious to agriculture are, under natural conditions, meteorological phenomena, the defensive reaction of the plant attacked, parasitism by means of microorganisms and certain fungi, as well as other difficulties of environment which may form an obstacle to the increase of the said injurious species. These factors may have a marked action in practice but they are not always within the sphere of our influence.

However that may be, whenever one hopes to obtain help from endophagous insects, against an injurious species, one must first consider whether the former take a sufficient part in the natural control of the pest under consideration or, whether, the controlling element is not to be found in one of the other adverse factors mentioned above. Otherurse, it is useless to look for what is not present in nature.

In order to estimate the possible effect of the use of entomophagous insects against injurious species, it is therefore advisable in practice to bear in mind the part they play in the complex of adverse factors acting on the particular species we are dealing with. It is evident that according to the number, efficacy, and other attributes of each of the other inimical factors, either singly or collectively, so the part reserved to the insects which prey upon the harmful species may be very variable.

Actually, this part can only be complete and actively capable of hindering the multiplication of the harmful species when this latter has little to fear from all the other factors and when the entomophagous insect is itself free from much attack. The part played may be of varying degrees of mediocrity when not only the particular efficacy of the entomophagous insect is mediocre (owing to the adverse influence to which it is itself subject) but also when the effect of the other inimical factors acting on the injurious species preponderates.

Finally, and this is a fact which should not be lost sight of certain cases not only in may the efficacy of entomophagous insects be completely *nil*

(1) For general considerations on the conflict, competition etc, between different organic species, where some are victims, others aggressors, I refer the reader to a note of mine written in 1907 which gives a general table of the various conditions under which this struggle takes place in nature ; see : *Considerazioni sui rapporti tra piante, loro insetti nocivi e cause nemiche di questi* ("Redia", Vol. IV, 1907, p. 193).

but they may even help to defeat the object in view when, by their share in the struggle, they tend to oppose themselves to the actions of the other factors adverse to the injurious species (from our point of view the only ones of real value), rather than exert an appreciably useful action upon the harmful species.

## Mode of action of entomophagous insects and their effect in practice.

The action of entomophagous insects varies in degree of usefulness according to their different habits of life and methods of reproduction. They may be classified as predatory, *i. e.* those which devour other insects and their eggs outside the maternal body; or endophagous, *i. e.* those which enter the body or eggs of their victim destroying all but the outer husk, or which devour the eggs while still retained in the abdomen or other specialised portions of the female body.

There are, moreover, entomophagous insects which feed exclusively on one species of victim; others, on the contrary are polyphagous and choose their victims among several species, either related or not, of other insects.

As regards reproduction, the useful effect varies according to the fecundity of the species, *i. e.* according to the number of generations multiplied by the number of feminiparous eggs. Further there must be taken into account the number and efficacy of the different adverse factors for each separate entomophagous species. I have often compared the different degrees of efficacy of entomophagous insects in relation to their different modes of life and reproduction, and have always concluded that the most effective as regards destruction of numbers and therefore the most useful in the case of species injurious to agriculture are those which prey exclusively on a single species, and which have themselves few enemies and few factors adverse to their survival. Next to these I rank the polyphagous endophagous species or those which are themselves subject to severe competition. Thirdly, come the predators with special victims and fourthly the polyphagous predatory species. The degree of prolificness of the different species in these categories, although not sufficient to alter their established order of importance, nevertheless forms a marked gradation within the categories themselves.

Bearing in mind the different conditions stated above, I will now enumerate the systems of control by means of entomophagous insects that have been followed hitherto with the object of discovering the reasons for different results in practice, and of seeing what may be expected from the natural means of control against harmful species hitherto subject only to artificial control.

1. *Entomophagous insects with useful action in the absolute sense* (Against insects injurious to agriculture). — For an insect to be useful in the sense implied above depends not only upon its own particular

nature (*i. e.* an endophagous species parasitising a definite victim, of great fecundity and little exposed to definite adverse factors) but also upon the victim itself, which, being very prolific, amply withstands all other limiting factors.

Nearly all insects of small size come under this category of victims and we know that it is owing to their small size that such a high degree of fecundity is required. Further, they are often polyphagous or they dispose of other expedients for preserving the species as a compensation for their smallness and the often insufficient means of defence of the individuals. Against these it is the entomophagous insects of the first category which have the greatest effect and which constitute the chief check on such excessive fertility.

Scale insects, Aphids and the other plant-feeders are exactly of this class, consequently if their special enemy is an entomophagous insect exempt from adverse factors of too active a nature, this latter is the absolute controller of the multiplication of the phytophagous species.

The effect of the entomophagous insect has been clearly shown in cases where an injurous species has been combated by placing it in contact with its particular endophagous species. Where injurious species have been imported into new regions from which their chief enemy is absent they have been free in consequence to exert their full activity, any other adverse factors being almost completely inadequate. Such insects have been able to multiply to an excessive degree for a certain period and have thereby proved the inadequacy of our artificial means of control. The intervention of the species which is their special enemy has proved the practical importance of these auxiliary insects for the protection of our plants, the pest having been reduced to proportions which, from the agricultural point of view, may be regarded as insignificant.

The two most striking examples in this sense are provided by *Novius cardinalis* against *Icerya purchasei* and neighbouring species, and by *Prospaltella berlesei* against *Diaspis pentagona*. These two auxiliary species have been spread beyond their native confines, at the expense of harmful species which at some previous time had made the same journey; they have been spread, and this is important, exempt from their particular enemies, with which no doubt they have to contend in their native country.

*Novius cardinalis and Icerya.* — This famous example is a scale insect which, by devouring the eggs contained in the ovisac spun by the mother, encompasses the complete desruction of the redoubtable *Icerya* and allied species (*I. aegyptiaca*, etc.). It was RILEY, in 1888, who first thought of utilising the natural enemies of this scale, then very widely distributed in California to the great detriment of the citrus groves. The same year RILEY sent KOEBELE to Australia where he found the valuable Coleopter and sent it to California. Its wonderful action was immediately apparent, for wherever this species was imported (and the same thing still holds), it annihilated, after only a few weeks, the biggest invasions of *Icerya purchasei*.

Soon after, (1892) *Novius* was introduced into the Hawaiian islands (after a previous fruitless trial in 1890); in 1900 it was introduced into Florida; in 1898 into Portugal; in 1901 into Italy; in 1907 into Syria and in 1893 into Egypt (in this latter case against *Icerya aegyptiaca*); in 1912, it was imported into France, in the neighbourhood of Nice.

At the present time, *Icerya purchasei*, which before the discovery of *Novius cardinalis* was considered a very great menace to citrus crops, has no longer any agricultural importance whatever.

Here the Coccinellid behaves more like an endophagous species than as a real predator. Its fecundity is greater than that of its victims; nor has it any parasites or special enemies in the localities where it has been introduced at the expense of *Icerya*.

*Prospaltella berlesei* against *Diaspis pentagona* (1). — If one takes into account the enormous difference in size and consequently in the number of individuals of *Diaspis pentagona* which, in comparison with *Icerya purchasei*, may find room on a plant, and also of the number of plant hosts, which for *Diaspis* is more than 50, many of which are wild, whereas *Icerya* has only two or three and these either cultivated or rare, it is easy to see that the task of *Prospaltella*, which consists in outnumbering its victim, is much harder than that of *Novius*; it is no matter for astonishment, therefore, if *Prospaltella* requires, in order to get the better of its victim in a certain locality, a period of time four or five times as long. However that may be, the task is eventually fulfilled just as completely.

*Prospaltella berlesei*, discovered, in 1906, by Berlese on *Diaspis pentagona* (var *amygdali*) from North America is the direct descendant of the species which in China and Japan, especially the former, reduced to insignificant proportions, from the agricultural point of view, *Diaspis pentagona*, probably a native of those countries. From 1906 onwards, *Prospaltella berlesei*, which at first was only found in the Far East, South Africa (Cape of Good Hope) and United States, has been distributed throughout almost all parts of Italy, Austria and Switzerland; more recently in Spain, the Argentine, Uruguay and, at the present moment, it is being forwarded to Brazil. In 1914, the Government of the Argentine Republic distributed throughout its territory 1 ½ million batches (2) of *Prospaltella* derived from the first consignment sent from Italy in 1909 and those immediately following. The facility with which this little wasp becomes acclimatised has been remarked in every country into which it has been introduced. In those localities where it has been established for more than two years the destruction of *Diaspis* from the agricultural point of view is very marked and it works equally well and equally quickly everywhere. *Diaspis pentagona* so destructive to mulberries, pear and other fruit trees, and also to forest trees and ornamental plants, has also lost all economic importance.

(1) See the article by Prof. Berlese entitled "The Control of the Japanese Fruit Scale" (*Diaspis pentagona*) in Italy. B. May 1913, pp. 697-703. (*Ed.*).

(2) Each batch consists of a small twig on which is a cluster of the scale-insects (*Ed.*).

Possibly in this same category should be placed the endophagi (ooendophagi) of *Perkinsiella saccharicida*, the little Fulgorid of Australian origin which caused such serious damage to the sugarcanes in the Hawaiian Isles, before Koebele and Perkins introduced there (in 1904, 1905) several species which preyed on its eggs. Among these ooendophagi the greatest activity was shown by two species of *Anagrus*, two of *Paranagrus* (*P. optabilis*, *P. perforator*) and by *Ootetrasticus beatus*. However, the two first named do not specially attack the eggs of *Perkinsiella*.

The beneficial effect of all these insects combined, at the expense of the Fulgorid, is, however, not such as to allow of an exact comparison with those of the two preceding cases. The reason is possibly because we are not dealing here with one *special* insect but with several, and undoubtedly the multiplicity of host-forms is an advantage to the victim.

It is easy to understand that the beneficial effects of these very efficient auxiliary insects is diminished by the intervention of other enemy entomophagous insects.

In every locality where *Novius cardinalis* has been introduced it has been exempt from enemies, hence its extraordinary success. Similarly with *Prospaltella berlesei*, which before being spread through Italy was first carefully freed from several species of Chalcididae, its endophagous parasites. Some scale insects, however, recently imported into Italy, *e. g. Rhizobius lophantae*, which has luckily only be able to spread over Southern Italy, owing to the climate, seems to hinder the action of *Prospaltella* on *Diaspis pentagona*, by devouring along with the scales, the young forms of *Prospaltella* contained thereunder. At the Cape of Good Hope where *Rhizobius* occurs, the action of *Prospaltella berlesei* is also less efficacious than in Central Europe where the climate does not allow *Rhizobius* to become established. TOWER, who discovered *Prospaltella perniciosa*, which attacks *Aspidiotus perniciosus*, definitely accuses the Coccinellidae, which prey on the same scale, of causing considerable damage to the endophagous species in this way (1).

2. *Entomophagous insects of mediocre efficacy and intermittent in action.*— This second category includes insects whose effective action is less sure, less constant and less uniform. The reasons for this are because they are themselves combated by certain entomophagous species or by other adverse factors, or because their victims are chiefly controlled by other special factors and consequently their increase or diminution does not depend on the entomophagi, or because they are polyphagous (or better polyxenous, *i. e*, having numerous hosts). It follows that if these latter find themselves in consonance with the other enemy factors acting on the victim the practical effect is nil, or in any case such action as there is cannot be attributed to the entomophagous insects.

(1) Berlese and Paoli have recently discovered (24th. Feb. 1916) in Madeira an endophagous Chalcidid (*Prospaltella lonunsburyi*) which destroys a very high percentage of *Chrysomphalus dictyospermi*, a scale which in Italy and elsewhere does great damage to a large number of useful plants, particularly citrus. They have already taken steps towards introducing it into Italy.

An example is afforded by the species of *Scutellista*, belonging to the Chalcididae, which behave as endophagi at the expense of species of *Lecanium*, though in reality they are ooectophagi, that is to say they devour eggs after they have been laid, but while they are still being carried beneath the abdomen of the mother, in the same way as *Novius cardinalis* devours the eggs in the ovisac of *Icerya*.

The principal cause of the excessive development and consequently of the serious damages caused by certain species of *Lecanium* (at least by native species), is the condition of the plant host, as we already shown, and any action on the part of oophagi is only very secondary; *Scutellista cyanea*, for example, can never cope with the large and sudden invasions of *Saissetia oleae* or *Ceroplastes* (*C. rusci* and *C. sinensis*). The above *Scutellista* has also been introduced, during the last ten years, into North America by HOWARD (forwarded by the Royal Station in Italy) and acclimatised in California in 1900. CRAW also acclimatised it in the Hawaiian Isles (1905) but always with the same effects already noticed in Italy. It is too much to hope, therefore, that any of the other insect enemies of *Saissetia oleae* hitherto discovered or acclimatised in localities from which they were absent, or which may be discovered in the future, will have the same constant and effective action as is seen in the cases of *Novius cardinalis* and *Prospaltella berlesei*.

However, *Scutellista cyanea* is considered as a great destroyer of *Leucanium oleae* in those parts of America into which it has been imported. According to Quayle, it destroys in California from 75 to 80 per cent of scale insects. At the same time it does not suffice to check excessive multiplication of the scale when the conditions of the plant host allow this maximum development

Among entomophagous insects tested as controls of *Saissetia oleae* in various parts of the globe, though with no better results than those quoted above, a large number of endophagous Hymenoptera should be mentioned. Examples are *Hymencyrtus cravii* Ashm, imported from Australia into California by COMPÈRE; *Tomocera californica* How.; *Myiamene comperi* Ashm., and other species of *Scutellista* in addition to those already cited. Further, numerous species of Coccinellid predators, such as *Rhizobius ventralis* Erich., *Orcus australasia* Boisd., *O. chalybaeus* Boisd. etc. as well as two Lepidoptera, *Talpochares coccipliaga* Meyr. and *T. scitula* Rbr.

We thus have a case where, instead of adopting natural means of control by seeking new and special entomophagous species, it is necessary to employ artificial methods, either direct or indirect, which result in the elimination of the fundamental cause of disease in plants, *i. e.* the state of the plant which allows of the multiplication of the *Lecanium*.

On the other hand, the special endophagi of other species of *Lecanium* such as *Coccophagus* for *Lecanium persicae* and *L. hesperidum* and *Comys bicolor* for the latter of the two foregoing, various endophagi for *Pulvinaria vitis* etc., do seem to be actually the most efficient factors in the reduction (although this reduction is only a very small one) of these species, which would otherwise be extremely injurious here at home, in the same way as

numerous foreign species of *Lecanium* would be for plants of their native country.

In this category of entomophagi of mediocre efficacy should be included, generally speaking, all Coccinellidae and other predators, either Phytophthires or other larger insects belonging to other orders.

Generally speaking, predators, that is, the true *ectophagi*, are much less efficient as destroyers of other insects, either because they are themselves combated by other entomophagi or because they are usually polyphagous. Nor do they persevere till the last individual of the victim species has been destroyed, as the endophagi do, but, when food begins to become scarce, they migrate.

This is the reason why species combated by predators though undoubtedly subject to periods of great destruction, also have intervals of revival where they multiply very rapidly ; and in these later cases, the species which feed on plants and fruit can be very injurious. Thus, the intervention of predators alone is not sufficient to check big invasions on the part of the victimised species, provided these latter are sufficiently polyphagous.

Some species, however, seem as a rule to be more active than others. For instance, many testify to the great efficacy of a Coccinellid, *Cryptolaemus montrouzieri*, from Australia, introduced by KOEBELE into California against various scale insects belonging to the Coccidae and Lecaniinae (*Pseudococcus*, *Lecanium* and allied genera *Pulvinaria*, *Eriococcus*, *Rhizococcus*). The same species, however, introduced by SILVESTRI, against the above groups of Coccidae, did not give results of any appreciable value. Numerous species of Coccinellidae of the genera *Rhizobius*, *Lipernes*, *Serangium*, *Trithionyx*, *Scymnus*, *Chilocorus*, *Pentilia* and the most promising species *Orcus chalibaeus* introduced in large numbers, chiefly into California, in order to combat several very injurious species of scale insects (particularly *Aspidiotus perniciosus*), have not given good results; these results cannot be even compared with those obtained by *Novius* and *Prospaltella*. Even in Italy, where some of the above species with the best reputations were introduced by SILVESTRI against native scales, no noticeable advantage accrued from their use.

*Aspidiotus perniciosus*, a great enemy of our fruit growing industry has been controlled hitherto (apart from spraying methods) by the importation of entomophagous insects, both predators and endophagi. It is the United States entomologists who have done most in this respect by sending naturalists into every region where the scale existed or was thought to exist. Nevertheless, the specific endophagous species, the one capable of rendering the terrible pest really impotent, has not yet been discovered. It seems that with the aid of the numerous endophagous species, all polyphagous however, which exist in California and which also feed on *Aspidiotus perniciosus*, this scale may prove, under certain conditions, less injurious. FERNALD (1914) states that these predators destroy sometimes as many as 90 per cent of the scale insects, but at the same time the remainder are sufficiently numerous to be able to continue the invasion in a very serious manner.

The species of endophagi which fight the terrible scale in greatest numbers, are as follows (among the Chalcididae): *Prospaltella perniciosa* Tower, *Aphelinus fuscipennis* How., *A. diaspidis* How., *Signifera nigrita* Ashm., *Perissopterus pulchellus* How., The two last species are of small importance. (HOWARD brings the number to 8 species). But the percentage of parasitism, in spite of the large number of Hymenoptera attacking the scale, is not superior (according to HODGKISS and PARROT, 1914), to 35 per cent ; spraying must still be employed, therefore, as a means of defence.

TOWER, who discovered *Prospaltella perniciosa*, states (1914) that this species is very active in Massachusetts, Pennsylvania and Colombia against the redoutable scale and would be still more so were it not for the interference of numerous Coccinellidae, which attack the *Aspidiotus* in question. However that may be, the action of this species of *Prospaltella* is undoubtedly far from being as effective as that of *P. berlesei* against *Diaspis pentagona*.

Among Coccinellidae, *Pentilia misella* appears to be the most active against *Aspidiotus perniciosus*.

The example afforded by this scale is one of the best for showing the small effect of a number of entomophagous insects on a single host species, when the former are not the special endophagi of the particular victim.

American entomologists have also tried for use against Aphids and particularly against *Schizoneura lanigera*, the acclimatisation of numerous species of predators, imported from New Zealand and Australia, belonging to the genera *Coccinella, Coleophora, Leis, Meda, Verania, Scymnus, Hippodamia*, etc., but the results have been of no practical value. *Hippodamia convergens* is the most numerous and most widely distributed species in North America. EWING (1914) calculates that in Oregon it forms from 50 to 90 per cent of the population of the Coccinellids of this State.

Its introduction into Italy for use against Aphids has not given results of any appreciable value.

*Schizoneura lanigera*, which causes such great damage to apple trees in our own country and which is one of the most redoutable species of Aphids, is not sufficiently combated by any insect, either among predators or endophagi. The waxy protection with which this Homopteran surrounds itself and the occurrence of a root-infesting form (*radicicola*) are sufficient to defend the species sufficiently and to afford it a practical security which it is difficult to overcome.

Aphids are most strongly attacked by endophagous species *e. g.* those belonging to the group of the Braconidae, which sometimes decimate their numbers or even wipe them out completely.

The practical activity of predators is still less marked against insects of other groups and usually of greater dimensions than the Phytophthires. On the other hand, the activity of endophagous insects is frequently most noticeable and often providential in character, especially that of those belonging to the Hymenoptera and Diptera. Nevertheless, their action is far from being a constant one, and is not sufficient to prevent the periodical reappearance of the pests.

This is the case, for example, with all the species which prey upon the Bombycidae and other Lepidoptera, diurnal and nocturnal. For instance in our own country, the large cabbage white butterfly (*Pieris brassicae*), though vigorously combated by numerous endophagi, both in its eggs and caterpillars (more than by predators), is still classed as one of the most injurious species. For the allied species, *Pieris rapae*, in America, RILEY imported *Apanteles glomeratus* from England, but with no better result than in Italy. In such cases even if a species is absent from a particular region, its place is taken by an allied species of exactly similar character.

A remarkable campaign has been undertaken by United States entomologists against *Limanthria dispar* and *Euproctis chrysorrhoea*, the two most injurious Bombycidae in our own country, which have recently been introduced into North America.

HOWARD, particularly, has introduced and acclimatised in America, from 1904 onwards, all the endophagous insects, from Europe and elsewhere, belonging to the above species. The result, doubtless an appreciable one, will be to reduce the damages caused by this species in the same proportion as has been accomplished in Europe, where the two moths, especially the former, put in appearances which, though serious in extent and duration, only occur over fairly long intervals of years. Undoubtedly, without the intervention of all these enemy organisms, which act as a brake on the two species, their presence in America would have been insupportable owing to the destruction of numerous species of shrubs and other plants which they attack. On the other hand there is no ground for hope that, even in America, the two species may be rendered definitely harmless through the agency of their insect enemies.

In addition to large Coleoptera, such as *Calosoma sycophanta* from Europe, now well acclimatised in America at the expense of the above mentioned Bombycidae and especially of *L. dispar*, numerous other entomophagous insects have been imported on various occasions and acclimatised for the same purpose. The results obtained have been given in various United States publications. Numerous Tachinidae from different parts of the globe have given useful results : *Blepharoripa scutellata* and others, a species of *Crossocosmia*, etc.

Chalcidids parasitic on the eggs of *L. dispar* have been imported from Japan, *Schedius kuwanae* How, *Anastantus bifasciatus* Fonsc., etc. Along with these, however, has been introduced *Tyndarichus navae*, which is a hyperparasite of *Schedius* and possibly also of the other species.

Predators and endophagi from various parts of the world have been called in to combat other injurious species of Lepidoptera in the United States. *Apanteles lacteicolor*, *Meteorus versicolor* and *Calosoma sycophanta*, as early as 1905, in Maine against various Lepidoptera and, later, a Tachinid and the two oophagous Chalcidids already mentioned.

Braconidae and Tachinidae were introduced into British Columbia in 1914 at the expense of *Heliophila unipuncta* and of *Plusia californica*. *Calosoma sycophanta* was introduced into Sumatra in 1913, against *Phygan-*

*india californica* and *Heliothis obsoleta*. The Director of the Deli Proefstation speaks highly of the effects of this importation.

Similarly in 1909-1910, a Chalcidid, *Trichogramma* (*Pentarthron*) *carpocapsae* Ashm. was introduced into Turkestan against the *Carpocapsa* of the apple but with poor effect, the extent of parasitisation not exceeding 2 per cent.

Many species of entomophagous insects have also been tried against the moths which damage the cotton plant in America, but with comparatively unsatisfactory results, etc. etc.

Nor have attempts been lacking to introduce into various regions endophagous insects to combat injurious species belonging to other orders, in the hope of obtaining useful results.

Among those which seem to have been most successful in this direction, a Tachinid (*Ceromasia sphenophori*) merits attention. This is an endophagous parasite of the weevil attacking the sugarcane (*Metamasius hemipterus*); it was introduced into Honolulu and (according to SWEREY) gave excellent results, as many as 87 per cent of the injurious insects being destroyed.

American naturalists speak very highly of the parasites, some of which have been imported, of *Anthonomus grandis*, which is considered as one of the chief insect pests of the cotton plant, but the nature of its effect has not yet been definitely fixed.

Prof. SILVESTRI has also been introducing for several years past, at the expense of our terrible *Dacus oleae*, several species of Hymenopteran parasites collected in Australia, South Africa, North Africa and more recently in Eritrea. The first batches were without effect; the effect of the more recent introductions is still being awaited and a certain amount of hope is entertained, although, in my opinion, the olive fly belongs to the group of insects which, in nature, has its increase limited by factors quite other than endophagous insects.

In conclusion, it is unreasonable to hope that an endophagous insect imported into a new locality can succeed in neutralising the effects of an injurious species indigenous to that locality, unless there is reason for crediting the existence in the world of a region where the said species, though harmful elsewhere, is agriculturally harmless. If so, it is in this region that the fundamental cause of this desirable state of affairs should be sought. It is quite possible that this cause may prove to be an entomophagous insect.

The importation of enemy forms of an injurious insect is, however, not always without danger. The fact must not be lost sight of that in these entomophagous insects one may often be dealing with double-edged weapons.

It has been said that the factors adverse to organisms are generally very varied in nature, and harmful species of insects are not exempt from this rule. It may thus happen that the importation of a species, even an entomophagous one, disturbs a certain state of equilibrium, by means of which the injurious form leaves room for a truce, precisely on account of other natural checks.

In this latter category, therefore, occur a large number of entomophagous species of no practical value — at least not to the point of saving a crop from destruction. It is among this great army of species, only relatively or superficially useful, that the entomologist, aided by the light of science and sound logic, must pick his way, not allowing himself to be led astray by false hopes. Generally speaking, it may be said that the study of the victimised species, or of its allied or closely related species, immediately provides useful data, which latter enable a conclusion to be drawn by means of reasonably likely arguments as to whether it is possible to admit the existence of enemy organisms capable of diminishing its numbers. In other words, if it is worth while to have recourse to natural methods.

It is evident that, it many cases, natural control can never be of practical value. In such cases it is better to avoid waste of time by employing artificial methods.

According to premises based on present knowledge which, however, experience might well show to be false, it seems that certain endophagous insects, which attack some very injurious species with considerable practical success, might be introduced into our own country in order to endeavour to control the same or allied species which cause similar damage in Italy.

For example, certain species of Diptera (*Sarcophaga cimbicis*, Towns; *S. hunteri*, Hough, and others), which are said to be very efficacious in the United States against Acridiidae (*Melanopus*), should have similar effects against the locusts in our own country.

A Chalcidid (*Telenomus ashmeadi*) destroys, in America, large numbers of the eggs of an injurious bug, *Pentatoma ligata*, and neighbouring species, and a Tachinid also attacks the adults. It is therefore feasible that the Hymenopter should at least display a certain activity against our native Pentatomidae which are so difficult to control by artificial means and so little combated by other predatory or parasitic insects.

*Lepidosaphes bekii*, the purple scale of the citrus, has no effective parasite in our country. Recently, PORTER has stated that in Chili there occur a Coleopter and Hymenopter which are strongly hostile to this species.

Similarly, certain Tachinidae belonging to the genus *Admontia* are, in America, efficacious parasites of Tipulidae; one has only to think of the damage certain species of Tipulidae cause in our rice fields.

The midges of wheat (Cecidomyiidae) and of other plants have, in America, many species of Hymenoptera as their enemies, *e. g.* a *Polygnotus*, which appears to be very useful against *Mayetiola destructor*. I consider that several species of these endophagous insects might succeed in Italy at the expense of indigenous midges.

The field is a vast one; and, so far, practically unexplored. The agricultural entomologist will render efficient service if, rather than proceed at haphazard, he brings his reason and the necessary biological knowledge to bear, especially with regard to those species which he wishes to combat with the help of auxiliary insects.

SECOND PART.

# ABSTRACTS

## AGRICULTURAL INTELLIGENCE

### GENERAL INFORMATION.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

266 – **The Field and Forest Resources of British Guiana.** — HARRISON, J. B. and BANCROFT, C. K. (Department of Science and Agriculture, British Guiana) in *The Journal of the Board of Agriculture of British Guiana*, Vol. VIII, No. 4, pp. 108-134. Demerara, September, 1915.

AREA AND POPULATION. — British Guiana covers an area of 57,700,000 acres, of which only about 2,000,000 acres are alienated from the Crown. Of the remainder, 9,000,000 acres are easily accessible for cultivation. The population is at present estimated at 304,149 of which 14,000 are European (including 10,000 Portuguese) and the rest East Indian, Chinese, Aboriginals and Blacks.

Most of the East Indians are associated with the sugar estates and rice cultivation on the coastal lands while the forest industries and gold and diamond mining are to a large extent carried on by persons of the African race.

CLIMATE. — The mean annual rainfall near the coast is about 94 inches and further inland about 105 inches. The distribution is fairly even, especially in the inland districts.

The average mean shade temperature near the coast is 80° F. and the greatest annual range is about 19° F.

SOIL. — The soil characteristics of the three great belts of the colony are as follows:

1. The alluvial coast belt is of exceptional fertility and its soils are among the richest and most fertile in the tropics.

2. The belt of the lower hills and plains covered with inexhaustible

forest lands is of less agricultural value, the soils being mainly sedentary. The regularity of the rainfall, however, enables arboricultural crops such as limes and Para rubber to be grown successfully.

3. The savannah belt is as yet undeveloped and contains belts of alluvial and fluviatile soils of considerable fertility.

LAND TENURE. *a*) For the cultivation of permanent crops such as rubber citrus, coconuts, etc:

No rent is payable during the first five years of the lease; from the 6th to the 10th year inclusive the annual rent is 25 cents per acre; for the remainder of the lease the rent is 80 cents per annum.

Each year for a period of seven years not less than $1/25^{th}$ part shall be planted and the cultivation shall be kept in good order to the satisfaction of the Governor-in-Council.

*b*) For the cultivation of other crops:

Crown land is granted under special circumstances for periods of 99 years or more at the following rates:

1) any area up to 5 acres, $ 1 per annum;
2) areas from 5 to 100 acres at 20 cents per acre per annum;
3) areas from 100 to 500 acres at 15 cents per acre per annum;
4) areas above 500 acres at 10 cents per acre per annum.

LABOUR. — The demand for labour in the sugar industry has made immigration from India a necessity. From 1901 to 1911 the average annual immigration of East Indians was 2435. The wages for field operations vary from 1/- to 2/- a day, cane cutters receiving from 1/6 to 3/6. Women earn from 10*d.* to 1/- and children 6*d.* to 8*d.*

CROPS. — *Coconuts*, sugar and rice are grown in the coastal region whilst cacao, coffee and rubber are grown on the river lands.

*Sugar cane.* — This is the most important of the agricultural resources of the colony. The area of land, 72 000 acres, under this crop is practically the same as it was 18 years ago, though the average yield is somewhat higher. Scarcity of labour is the chief factor limiting the expansion of the industry. The export in normal years averages 110 000 tons of sugar valued at £1,179,218 though it is estimated that the total available land suitable for sugar cultivation is capable of yielding 2 ½ million tons annually. The " Bourbon " variety famous as a source of " Demerara " crystals has suffered considerably of recent years from fungoid diseases and $4/5^{ths}$ of the area are now planted with other varieties capable of higher yields but giving inferior crystals.

*Rum.* — British Guiana rum is produced by a rapid fermentation, extending from 36 to 48 hours, of molasses diluted with water. Investigation on scientific lines has brought the process almost to perfection. Owing to the rapidity of the yeast fermentation other organisms are excluded so that a less flavoured product is obtained.

*Molascuit.* — This consists of a mixture of the finer particles of the interior spongy tissues of the sugar cane, separated from the megass produced during the grinding of the cane. It is a dry, brown coloured,

coarse powder with a fragrant odour, containing 72 per cent of readily digestible constituents.

*Rice.* — The development of this cultivation is due to the East Indian settlers. The rice generally grown is a long-grained variety known as Creole rice and has apparently originated by unconscious selection. The choicest strain is known as the " Berbice ". The primitive Eastern methods are generally practised, but modern appliances have recently been tried with promising results. Two kinds of rice are made, a brown steamed rice and a white rice. No rice polishing is carried out but rice-meal is produced as a bye product and exported. The average yield per acre for the colony is 22.2 cwts.

*Coconuts.* — The coconuts palms growing in the colony are scattered, but extension of the cultivation over large areas is steadily taking place. The palms flourish in the light sandy loams of the coastal regions but they are not successful on the pegassy-clay lands and on river lands away from the coastal region. The area under coconuts in 1915 was 15,260 acres, most of which has not yet come into bearing. The exports during 1912-14 averaged 1 427 644 nuts mostly exported to the United States. Only small quantities of copra are made in the colony.

*Coffee.* — Both Arabian and Liberian coffee grow with exceptional vigour and the former is singularly free from disease.

The scarcity of labour tends to restrict the extension of the area under cultivation, which now reaches 3800 acres. The Liberian variety is very prolific and often requires checking to prevent it from exhaustion. A large proportion of the coffee is consumed locally. The exports in 1914 reached 2132 cwts.

*Cacao.* — The Forastero is the chief variety grown. Most of the crop is consumed locally so that the export is small. About 2000 acres are under this crop and owing to lack of capital with the small farmers this promising cultivation does not extend.

*Rubber.* — There are 5 species of *Sapium* indigenous to the colony, two of which yield rubber of marketable quality.

*Sapium* rubber from the wild forest trees was formerly exported as " Orinoco Scrap ". Since 1907, Para rubber has been planted, and there are now about 450 acres under this cultivation. Tapping operations on a more extensive scale are anticipated during the next year. It is estimated that a reasonable profit can be expected with rubber selling at 2/- per lb. The low cost of supervision of the estates and the proximity of the colony to the United States are factors which should encourage the extension of this industry.

*Limes.* — They grow well on the lighter soils if protected from the full force of the wind. There are about 1000 acres under this crop and there are large areas of loose friable land and ferruginous laterite soils very suitable its cultivation. Selection experiments are being carried out to improve the yield of acid.

*Cotton and other fibres.* — Only the indigenous tree cottons are grown

with success. The lint is short-stapled and of similar quality to rough Peruvian worth 6*d.* to 9*d.* per lb.

Hybridisation experiments have been carried out with the object of producing a heavy bearing perennial variety with lint of the Sea Island type.

*Hedychium coronarium*, the Ginger Lily, is a promising fibre crop. In an experimental plot a first crop of 22 tons per acre was obtained six months after planting and a ratoon crop of 27 tons was obtained six months after.

CATTLE RAISING. — Large areas of the coast land are suitable for cattle raising and there are about 90,000 head of cattle in the colony. The savannahs are scattered areas of well watered fertile land and are considered as specially well adapted to cattle raising.

FOREST RESOURCES. — The forests cover some 78,000 square miles the workable area of which is confined at present to 11 000 square miles. The more important commercial timbers are given below:

1. Greenhart is the best known of the timbers and is used for submerged works, such a wharves, piles, dock and lock gates. Logs may be obtained from 10 to 25 inches square and 65 feet long.

2. Crabwood or West Indian Mahogany (*Carapa guianensis*). The red variety is used for building purposes and furniture.

3. Wallaba: " Soft Wallaba " (*Eperna falcata*) and " Huri Wallaba " (*Eperna Jenniani*). A heavy resinous wood with unpleasant smell used for posts, shingles, palings and vats.

4. Hard Woods: " Mora " (*Dimorphandra Mora*) for railway sleepers; " Bullet tree " (*Mimusops globosa*); Surandanni (*Hieronima alchorneoides*); " Purple Heart " (*Copaifera publiflora*); Locust or Simiri (*Hymenoea Courbaril*); " Hackia " (*Siderodendron triflorum*); Towaronero (*Humiria balsamifera*); Kakaralli (*Lecythis corrugata*); Tonkin bean or Kumara (*Dipteryx odorata*); Hiawaballi (*Omphalobium Lambertii*); Kabukalli (*Goupia glabra*); and Phokadie (not identified).

5. Soft Woods: Silver ball (*Nectandra* spp.); Hooboballi (*Mimosa guianensis*); Arrisouroo (*Pterocarpus guianensis*); White Cedar (*Tabebuia longipes*) and Red Cedar (*Protium altissimum*); *Simarupa officinalis*; Dalli (*Myristica surinamensis*) and Photee (*Jacaranda Copaia*). Firewood is obtained from *Avicennia nitida*.

Charcoal is also made for export to the West Indian Islands.

Forests products are: Gum Animi (*Hymenoea Courbaril*); Hiawa gum (*Protium heptaphyllum*); Souari or Butter nuts (*Caryocar tomentosum*); " Crab oil " from seeds of *Carapa*.

RURAL HYGIENE

267 - **The Healthiness of Rice Fields in Italy.** — BORDIGA, ORESTE in *Il Giornale di Risicultura*, Year VI, N° 1. pp. 3-11. Vercelli, January 15, 1915.

The writer shows that the cultivation of rice has no injurious influence on health nor on the vigour of the race, whilst it yields a much greater income per unit area than that of other more important and more widely cultivated crops. Making use of recent sources of information he shows the progress and well-being from an economic, social and hygienic point of

view that Italy has derived from this cultivation and shows how devoid of serious foundation are the accusations against its unhealthiness.

The exportation of rice has been a source of continually increasing profit until the present crisis, as shown by the following figures:

*Mean annual export in thousands of cwts.*

| | 1891-1896 | 1908-1910 | 1911-1912 | 1913 |
|---|---|---|---|---|
| Paddy | 65 | 266 | 484 | 427 |
| Cleaned rice | 663 | 728 | 1 128 | 880 |

This corresponds to a value of about one million sterling, in addition to the value corresponding to the home consumption, obtained from a crop occupying scarcely 361 000 acres.

The area under rice, however, has diminished during the last 20 years. In 1875 it was more than 494,000 acres, in 1894 it was 408,000 acres and at the present time it reaches only 361 000 acres. The yield, on the contrary, has increased from 15 779 541 bushels = 6 211 000 cwts in 1894 to 9 578 000 cwts at the present day. The total yield has therefore increased by about 54 per cent and the yield per acre has increased still more, the actual figures being 15.22 cwts per acre in 1894 and 26.53 cwts per acre at the present time or an increase of 74 per cent. No other Italian crop can even approach these figures, as shown by the following table:

*Comparative yields of cereals in Italy in* 1880-1884 *and in* 1909-1914.

| | Yield in cwts per acre | | Percentage increase |
|---|---|---|---|
| | 1880-84 | 1909-14 | |
| Wheat | 6.60 | 82.3 | 24.7 |
| Maize | 10.75 | 13.22 | 23.3 |
| Oats | 6.37 | 8.30 | 30.1 |
| Rye | 6.55 | 7.22 | 10.3 |
| Barley | 6.13 | 6.72 | 9.6 |
| Rice | 14,50 | 26.69 | 84.1 |

Whilst the other cereals require 20.25 per cent of the value of the crop in labour, rice cultivation demands from 23 to 35 per cent.

Valuing wheat at just over 12 s. per cwt and paddy at 8 s. 10 ½ d. per cwt. the value of the crops per acre excluding the milling is as follows:

| | Value of yield | | | Cost of Labor | | | |
|---|---|---|---|---|---|---|---|
| | £ | s | d | | £ | s | d |
| Wheat 8.23 cwt. per acre | 4 | 19 | 5 | (1/4) | 1 | 4 | 10 |
| Rice 26.69 » » | 11 | 16 | 7 | (1/3) | 2 | 14 | 2 |

These figures give some idea of the benefit to the cultivator from rice cultivation.

The effect of rice cultivation on the health of the inhabitants is shown by the greater diminution in the death rate from malaria in the districts between the Po and the Ticino in proportion to the increase in this cultivation. The diminution in the death rate per thousand from the period 1875-1888 to 1902-1912 is shown by the following figures:

| Districts | 1875-1888 | 1902-1912 |
|---|---|---|
| Novara | 28.68 | 18.6 |
| Vercelli | 29.11 | 16.5 |
| Pavia | 24.09 | 19.6 |
| Mortara | 27.75 | 15.2 |

The writer compares these figures with those relating to the districts of the same region where rice is not cultivated and shows that the diminution in the mortality during the same period is about the same as in the rice districts, though the former districts (e. g. the mountains of Sondrio) are considered to be very healthy.

Although rice cultivation is said to favour malaria and occasionally fatal cases have been recorded, the disease is much less serious and less prevalent in rice-growing districts than in other districts.

This is shown by the figures in the table below which compares the number of deaths caused by malaria in Italy during the period 1896-1898, when the method of prevention of the disease was unknown, with the death rate in the period 1910-1912 when preventive measures were adopted everywhere.

Thus, of the total deaths caused by malaria during the triennial period 1910-1912, 5.5 per cent were in northern Italy and the remaining 94.5 per cent were in the rest of the country.

*Comparison of the numbers of deaths due to Malaria in Italy in* 1896-1898 *and* 1910-1912.

| | Triennal period | | Percentage diminution |
|---|---|---|---|
| | 1896-1898 | 1910-1912 | |
| Northern Italy: | | | |
| Piedmont | 581 | 38 | 6.5 |
| Liguria | 65 | 12 | 9.6 |
| Lombardy | 822 | 96 | 11.6 |
| Venetia | 1 099 | 366 | 33.2 |
| Emilia | 607 | 101 | 16.6 |
| Rest of Italy | 42 601 | 10 595 | 24.8 |
| Entire country | 45 775 | 11 208 | 24.6 |

Further, the decrease was greatest in Piedmont, the greatest rice growing district. There is therefore no truth in the statement that rice fields and malaria are inseparable.

The question of the effect of rice fields on the physique of the inhabitants is shown by the proportion of discharges from the army. During the quinquennial period 1886-1890 the percentage of discharged soldiers in the rice growing districts was equal to or a little less than those of the neighbouring provinces, whilst the percentages in the regions of southern Italy,

where rice fields are almost unknown and where the malaria is of a much more serions type, were much higher, almost double and even more in some cases.

## CROPS AND CULTIVATION.



268 – **Soil Gases.** — LEATHER, I. W. (Imperial Agricultural Chemist), in *Memoirs of the Department of Agriculture in India, Chemical Series*, Vol. III, No 3, pp. 85-132. Fig. 1-2. Calcutta, October 1915.

In the determination of the composition of the soil gases, the amount of argon was included as a means of indicating the source of the oxygen and nitrogen present, whether the latter had been merely liberated, or the former assimilated. The volume of gases in the soil was determined directly by means of a modification of the writer's soil sampling apparatus, whereby the gases were extracted under reduced pressure from a given volume of the soil. A special apparatus was devised for the determination of small quantities of argon and the ratios of oxygen to argon and nitrogen to argon were accurate to within 10 per cent.

The results of these investigations on Pusa soil and of the gases from irrigated rice fields are as follows. The volume of gas in the soil as found by direct determination is approximately equal to that obtained by calculation from the volume of the soil particles and water present. The sum of the volumes of the various constituents determined separately is usually somewhat greater than the volume of the fresh soil, indicating a small condensation of gas on the soil particles, the volume of such condensed in the Pusa soil is certainly less than 4 per cent of the total gas present. The volume of gas displaced from soil by water is never exactly equal to the volume of water added, and during the wettest weather the volume of gas only falls to about 20 to 50 per cent of the volume present during long periods of hot dry weather. The gas from soil which has been freshly treated with farm manure or green manure naturally contains a high proportion of carbon dioxide and a low proportion of oxygen but these proportions are somewhat modified by diffusion.

Analysis of the gases in the neighbourhood of the roots of *Crotalaria juncea*, *Indigofera arrecta* and maize showed very high percentage of carbon dioxide (8 to 16.9) and low percentage of oxygen (2.3 to 13) and small quantities of hydrogen (0.5 to 1.4 per cent). Although carbon dioxide is considered to be excreted by the roots of higher plants there is no evidence to show that it is not actually produced by lower organisms. The liberation of hydrogen must be due to the agency of an entirely different class of biochemical change from that concerned with the assimilation of oxygen or the production of carbon dioxide. Although the percentage of carbon dioxide is frequently high, most of it is present in the dissolved state in the soil solution.

(1) See also *B.* June 1915, No 571. (*Ed.*).

The determinations of the ratios of oxygen and nitrogen to argon indicate that the chief changes in the soil are concerned with the oxygen, whilst nitrogen-assimilation or nitrogen-evolution in dry land is at least so limited that it is usually difficult to detect. On the other hand, in cases like the gas from rice land, the argon determination demonstrates with certainty that most of the nitrogen is derived from the soil and manure.

The amounts of the gases diffusing into or out of the soil have been calculated on Buckingham's assumption that the quantity of gas diffusing depends upon the "porosity" or interspace occuped by the gas. The results show that the diffusion of the carbon dioxide is according to expectation but that the amounts of oxygen entering the soil are much greater than might be expected from the amounts of carbon dioxide or nitrate which may be found concurrently. It is concluded that the diffusion of gases at a depth of 12-15 inches is so efficient that soil cultivation for the purposes of aeration is apparently unnecessary The well established value of good cultivation must therefore be referred to other causes.

269 – **The Activity of Soil Protozoa.** — Koch, G. P. (Research Fellow, New Jersey State College), in *Journal of Agricultural Research*, Vol. V, No. 11, pp. 477-488. Washington, D. C., December, 1915.

These experiments were carried out to determine the condition of the protozoa in the soil and the conditions determining their excystation. The direct method of examining the soil microscopically was found most satisfactory. In each case a small portion of the soil sample was placed on a glass slide and stirred with a few drops of tap water. The time at which the water and soil were mixed was noted and the examination completed within two minutes.

Twenty greenhouse soils were examined in this way and in six cases active protozoa were found. In all these cases the soils were of open structure and their moisture content was much above their optimum.

Fourteen field soils were examined similarly and in no case were any motile protozoa observed. Samples of standing rain water and water-logged soil always showed the presence of motile protozoa.

Experiments were then made with three soils incubated at various temperatures and with different amounts of moisture from air dry to 1 ½ times optimum moisture content. No motile protozoa were found, except in one case, that of field soil containing 1 ½ times optimum moisture and in this case the soil showed a small depression in which a little free water had accumulated; increasing the water to 2 and 2 ½ times optimum resulted in the appearance of motile organisms at all temperatures (5° to 33° C.) in each soil. It is therefore concluded that moisture is the most important factor determining the excystation of the protozoa.

Attempts were then made to determine the length of time required for excystation of the organisms. The shortest period of incubation was between 2 and 3 hours at a temperature of 22° to 24° C. for the smaller ciliates, whilst flagellates require from 6 to 8 hours and large ciliates 40 hours. Thus the microscopic examination of the soil under water for a period of two minutes will show only the presence of the active protozoa in the sample.

270 - **Experiments in Disinfecting Marshland in Germany.** — NOSTITZ A., in *Landwirtschaftliche Jahrbücher*, Vol. 48, N° 4, pp. 587-606. Berlin, October 26, 1915.

By treating marshy soil with disinfectants (carbolineum etc.) the writer obtained a great increase in the yield. This increase was more marked when the disinfectant had been applied some time before sowing than when it was used later. The best return was obtained by the use of from 50 to 60 gms. of carbolineum per cubic metre. A carbolineum rich in volatile substances increased the yield more than one containing less. Its action is chiefly upon the number of bacteria and Nematodes in the soil.

271 - **Blueberry Culture as a Means of Utilizing Acid Soils** (1). — COVILLE FREDERICK C. in *U. S. Department of Agriculture, Bulletin* N° 334, 16 pp., XVII plates. Washington, December 28, 1915.



Blueberries, the best of which, for cultivation, is the swamp blueberry (*Vaccinium corymbosum*) require :

1) an acid soil, and they thrive best in that particular type of acid soil which consists of a mixture of sand and peat.

2) good drainage and thorough aeration of the surface soil and

3) permanent but moderate soil moisture. Under such conditions the beneficial root fungus which is believed to be essential to the nutrition of the plant develops freely.

Situations liable to late spring frosts should be avoided, for while the blueberry plant itself is seldom injured by freezing, its crop of fruit is often destroyed in this way.

At present the best way of propagating the swamp blueberry is by cuttings from the best wild bushes. Grafting and especially budding are not suitable for commercial plantations because blueberry bushes are continually sending up new shoots from the stock.

A large wild plant can be divided into as many as 30 plants each with its own small portion of the root mat, and, by utilizing the various methods of propagation (cuttings, rooted shoots, root cuttings etc) as many as 600 plants have been made from a single very large wild bush.

Plants from cuttings or rooted shoots are ready for a permanent field planting when they are 1 or 2 years old and 6 to 18 inches high. As some bushes are almost completely sterile to their own pollen, it is important that a plantation should not be made up wholly from cuttings from one bush. Two stocks should be used in alternate rows. In the permanent field plantation the bushes should be set 8 feet apart each way. The ground should be ploughed to a depth of about 8 inches and repeatedly harrowed or otherwise tilled during the season preceding the planting, in order to keep down all competing vegetation. The tillage of the plantation after the young bushes have been set should be shallow and it is best accomplished by a small light spring tooth cultivator with the teeth set closer together than usual.

In case of drought, subirrigation may be used on perfectly level ground,

(1) See also *B.* Feb. 1915, N° 191 (*Ed.*)

but on uneven areas surface irrigation, if accompanied by good drainage, is preferable.

Fertiliser experiments have shown that lime is positively injurious to blueberry plants, and that stable manure, while producing a temporary stimulation of vegetative growth is likely to cause serious injury later. An acid mixure of the following composition, at the rate of 1000 pounds per acre is recommended :

| | Pounds |
|---|---|
| Acid phosphate (high grade, about 16 per cent available phosphoric acid) | 600 |
| Sulphate of potash (50 per cent potash) | 200 |
| Sulphate of ammonia (20 per cent nitrogen) | 200 |

This and similar acid mixtures have been used with success on blueberry plants in both pot and field experiments. However, as no fertilizer is required to make swamp blueberry fruit abundantly and continuously in suitable peat and sand soils properly handled, the use of fertilizers in commercial plantations is not at present advocated.

The plants in field plantations come into bearing when 3 to 4 years old (in greenhouses they often ripen a few berries in less than a year). Wild bushes of the swamp blueberry often live 50 to 100 years bearing heavily.

A plantation near Elkhart, Indiana, about 2 ½ acres in extent gave, between 1910 and 1915 when it was 21 to 26 years old, the following yields and receipts :

| | | |
|---|---|---|
| Average yield per acre | 1 741 | quarts |
| » price per quart | 14 ½ | cents |
| » receipts per acre | $ 243.44 | |
| » profits per acre | » 116 | |

The expenses were :

| | | |
|---|---|---|
| Weeding, cultivation and irrigation | $ 20 | per acre |
| Cost of picking | » 0.05 | per quart |
| General cost of maintenance of equipment | » 2.00 | per acre |
| Interest | » 12.00 | » |
| Taxes | » 2.00 | » |
| Depreciation or sinking fund | » 4.00 | » |

This plantation was made by transplanting wild bushes without selection as to productiveness or size of berries. With selected varieties the yield should be greater.

Conclusion : " The introduction of the blueberry into agriculture has a much more profound significance than the mere addition of one more agricultural industry to those already in existence. Blueberries thrive best in soils so acid as to be considered worthless for ordinary agricultural purposes. Their culture, therefore not only promises to add to the general welfare through the utilization of land almost valueless otherwise, but it offers a profitable industry to individual landowners in districts in which

general agricultural conditions are especially hard and unpromising, and it suggests the possibility of the further utilization of such lands by means of other crops adapted to acid conditions (1).

272 - **The Absorption of Ammoniacal Gas by Superphosphates and the Use as Fertilisers of the Phosphates thus obtained.** — GERLACH, in *Zeitschrift für angewandte Chemie*, Year 29, Vol. 1., pp. 13-14, Leipzig, January 11, 1916.



Ammoniacal gas on passing over fresh or dried superphosphate is readily absorbed by this fertiliser with the production of heat. One molecule of monocalcic phosphate absorbs 4 molecules of ammonia gas. Owing to the gypsum contained in the superphosphate, other transformations take place, of which the final products are insoluble phosphate of lime and sulphate of ammonia. The reaction is as follows :

$$Ca\,H_4\,(PO_4)_2 + 2\,Ca\,SO_4,\,2H_2\,O + 4NH_3 = 2\,(NH_4)_2\,SO_4 + Ca_3\,(PO_4)_2 + 4\,H_2\,O$$

It is probable that double salts are formed as intermediate products and that this reaction is only complete in an aqueous medium. Theoretically, 100 parts of phosphoric acid ($P_2O_5$) absorb 39.4 parts of ammoniacal nitrogen.

In his experiments, the writer used finely ground fresh superphosphate. By passing a current of ammonia gas over this in a revolving drum, the greater part of the gas was soon absorbed. This absorption set free so much heat that the water in the superphosphate entirely evaporated and there only remained in the drum an amorphous dry mass, easily reduced to powder. The unabsorbed ammonia gas can be used to repeat the process.

In order to obtain sufficient of the fertiliser for a manurial experiment, the writer repeatedly treated varying quantities of superphosphate (25 to 30 kg.) with ammonia gas. It is considered that the process could be used industrially.

The following is the percentage composition obtained by passing 370 litres of ammonia gas over 3 kg. of superphosphate:

| | | | |
|---|---|---|---|
| Water (hygroscopic) | 3.42 | Total sulphuric acid | 30.92 |
| Total nitrogen | 7.15 | Sulphuric acid soluble in water | 24.48 |
| Total phosphoric acid | 16.73 | Oxide of iron and alumina | 1.48 |
| Phosphoric acid soluble in water | 1.13 | Substances insoluble in hydrochloric acid | 4.26 |
| Total lime | 24.78 | | |
| Lime soluble in water | 3.34 | | |

With the help of these data, the following percentage composition can be estimated :

| | |
|---|---|
| Hygroscopic water | 3.42 |
| Sulphate of ammonia | 33.71 |
| Bicalcic phosphate | 2.74 |
| Tricalcic phosphate | 30.10 |
| Sulphate of lime | 22.55 |
| Phosphate of iron and alumina | 2.96 |
| Insoluble substances (silica etc.) | 4.26 |
| Total | 99.74 |

(1) See on this subject: *The Agricultural Utilization of Acid Lands by Means of Acid-tolerant Crops*». *United States Department of Agriculture, Bulletin*, N° 6, 1913. (Author's note).

The phosphoric acid of superphosphate treated with ammonia gas is almost always insoluble in water, but is readily soluble in weak solutions of citric acid, as the following experiment shows :

5 gms. of analysed fertiliser containing 16.73 % of total phosphoric acid were shaken up with 500 cc. of 1 % and 2 % citric acid solution respectively. The amount of phosphoric acid dissolved was as follows :

1) In the 1 % solution of citric acid : 14.63 % of $P_2O_5$.
2) In the 2 % » » 16.27 % » »

The phosphoric acid from superphosphate acted upon by ammonia gas is easily dissolved by water containing carbonic acid.

The ammonia gas absorbed is not liberated from the superphosphate when this is kept, even for several months, as is shown by the following figures :

| Date of analysis | Total nitrogen | Nitrogen soluble in water |
|---|---|---|
| March 18 . . . . . | 6.61 % | 6.47 % |
| May 29 . . . . . | 6.54 % | 6.34 % |

In order to determine wheter the fertiliser thus obtained was suitable for manuring crops, and could replace ordinary " Ammoniak superphosphat " (a mixture of superphosphate and sulphate of ammonia) the writer made, from 1913 to 1915, numerous comparative manurial experiments with oats and white mustard grown in pots and on plots of 1 sq. metre. He obtained, on an average, with ordinary " Ammoniak superphosphat, " 100 units of return, and with the new fertiliser 101 ; this proves that the latter fertiliser is no wise inferior to the former.

273 – **Manurial Experiments in Germany with New Forms of Nitrogenous Fertilisers.** — SCHNEIDERWIND, in *Deutsche Landwirtschaftliche Presse*, Year 43, N° 7. p. 48. Berlin, January 22, 1916.

During the last few years a large number of new forms of nitrogenous fertilisers have been recommended in Germany. The following are the principal :

" Stickstoffskalk " (1) ; nitrate of lime (under the names of Norwegian saltpetre and Schloesing saltpetre) ; urea ; nitrate of urea ; ammonium nitrate ; ammonium chloride ; double sulphate of ammonia and soda ; ammonium carbonate.

The writer has tried these fertilisers on different crops (potatoes, sugar beets, mangolds, oats, rye and wheat) in the field, in order to determine their productive value in comparison with that of nitrate of soda and of sulphate of ammonia. The following table gives the nitrogen percentages of these fertilisers.

(1) The German « Stickstoffskalk » is much the same as Nitrolim or $CaCN_2$, there being merely a slight variation in the process of manufacture. (*Ed.*).

| | | |
|---|---|---|
| Nitrate of soda | | 15.6 |
| Nitrate of lime | Norwegian saltpetre | 12.6 |
| | Schloesing saltpetre | 13.8 |
| Ammonium nitrate | | 34.5 |
| Ammonium sulphate | | 20.8 |
| Ammonium chloride | | 25.3 |
| Urea | | 46.4 |
| Nitrate of urea | | 34.0 |
| Nitrolim | | 117. |

So far, with the double sulphate of ammonia and soda and ammonium carbonate, only pot experiments have been made. From the results of these experiments, the writer draws the following conclusions :

1) Ammonium chloride has the same productive value as ammonium sulphate. The double sulphate of ammonia and soda, has, according to the pot experiments, the same effect. Both these fertilisers can thus replace ammonium sulphate.

2) Ammonium nitrate, urea and nitrate of urea generally give the same result as sulphate of ammonia ; in some cases, they are even equal to nitrate of soda. Urea, and perhaps nitrate of urea, alone have any practical value, for ammonium nitrate is hygroscopic and readily explodes.

3) Nitrolim may give the same results as the preceding, but it is only effective if the weather is very dry during the chief growing period. In general, it must be admitted that its productive value is a little lower than that of the above fertilisers.

4) Nitrate of lime has the same productive value as nitrate of soda but it is more hygroscopic, which decreases its usefulness. Potassium nitrate has less productive value than sodium nitrate.

274 – **Recent Investigations of the Action of Manganese on Plant Growth** (1). — Masoni Giulio in *Le Stazioni sperimentali agrarie italiane*, Vol. XLVIII, Part. 10-11, pp. 822-838. Modena, 1915.

Pugliese (On the Biochemistry of Manganese : the ratio of Manganese to Iron in Vegetation - *Reale Istituto d'incoraggiamento di Napoli*, 1915) has shown that there is a definite optimum ratio between iron and manganese in the soil and that the failure to recognise this fact probably accounts for the uncertainty of the results obtained with manganese as a manure.

Taking into account the facts observed by Menozzi concerning the probable chemical reation of the manganese salts with other compounds of the soil, and also the effect of the added acid radicle, especially the sulphate, the writer carried out experiments with sodium sulphate in addition to the sulphate of iron and manganese in quantities containing equivalent amounts of sulphate.

The conclusions of these experiments are as follows :

1) The addition of sulphate of soda or of sulphate of manganese alone gave equally advantageous results.

(1) See *B.* June 1911, N° 1701 ; also *B.* 1912 N° 779, *B.* 1914 N° 613, 717, 984, *B.* 1915, N° 471 and 1273. (*Ed*).

2) Sulphate of manganese (apart from its specific toxic action in large quantities) had rather an injurious than a favourable action, whilst the corresponding beneficial effect was due to the $SO_4$ radical and the action of the soluble salt.

3) The results obtained suggest that the varying effects of sulphate of manganese may be attributed more to its action as a soluble salt and more particularly to the acid radicle than to the specific action of the manganese.

Another series of experiments was then carried out to compare the action of compounds of manganese with similar compounds of other bases (preferably sodium since its effect on vegetation is very slight).

The chemical equivalence of the anions was taken into account and corresponding weights of the same acid radicle were used in each case, so as to be able to compare the action of the various acid radicles.

The experiments were made in 1912 with maize followed by buckwheat in 1913 and in 1915 with maize in earthenware pots. The quantities used per kilo of soil were: manganese 5 to 50 mg.; iron 10 mg.; sodium 4.16 to 49.95 mg.; sulphate radicle 8.72 to 104.39 mg.; chlorine 12.97 to 64.85 mg.; carbonate radicle 27.45 to 137.25 mg.

The quantities of manganese calculated per acre are relatively high. The limits of toxicity, however, were never reached, since in almost every case the yield was higher than that of the control without salts.

The conclusion to be drawn from these results is that though compounds of manganese in small or large doses have a favourable influence, it cannot be regarded as a specific action of the manganese since it was not greater than when the corresponding sodium or calcium compounds were used. In some cases the sodium compounds have even shown a greater effect than the corresponding manganese salts.

The results confirm, therefore, the theory that the varying effect of manganese salts can sometimes be attributed to their action as salts (especially if they are readily soluble) and to the acid radicle rather than to the particular action of the manganese.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS

275 – **New Observations on the Concretions in the Pulp of Pears.** — Rivière Gustave and Bailhache Gabriel, in *Journal de la Société Nationale d'Horticulture de France*, Series 4, Vol. XVI, pp. 188-189. Paris, December 1915.

From research made chiefly on the Passe-Crassane variety of pear, the writers conclude that the much thickened cells occurring in the pulp of all pears, even the softest, are not stony concretions (Grew), nor are they the result of a disease of the utricular tissues (Meyer). It is a question of cells which have become lignified instead of their walls remaining thin and soft. The chemical analysis of these agglomerations of so called sclerotic cells confirms the microscopic examination. In actuality these solid granular bodies are much poorer in ash than the thin-walled cells composing the greater part of the pulp. These sclerotic cells have, further, the power of becoming saccheriferous under the influence of dilute hydrochloric acid.

The writers think that they present a certain analogy with the horny albumen of the kernel of *Phytelephus macrocarpa*, which is known in com-

merce under the name of " corozo ", or vegetable ivory. This question is being made the subject of further research.

276 - **Ash Composition of Upland Rice at Various Stages of Growth.** — GILE, P. L. and CARRERO, J. O. (Porto Rico Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. V, N° 9, pp. 367-364. Washington, D. C. November 29, 1915.

In the course of work on the effect of the lime-induced chlorosis on the ash composition of the plant it was necessary to know how the iron content of the plant varied with its age.

The plants examined were grown in Porto Rican red-clay soil well supplied with sulphate of ammonia, acid phosphate and muriate of potash.

The conclusions from these results are :

1. The percentage of potash, phosphoric acid, and sulphur in the ash of the whole plant above ground decreased with the age of the plant, while the silica increased and the nitrogen in the dry matter decreased with age.

2. The aerial portion of the mature plant at 123 days with ripe grain compared with that of a plant 103 days old with the panicles just out, contained an equal amount of lime, magnesia, and phosphoric acid, slightly more iron, sulphur, chlorine, nitrogen, and silica, much less soda and considerably more potash.

3. While the iron content of the ash of the whole plant varied but little with the age of the plant, the percentage of iron in the ash of the green straw and leaves decreased markedly with its age. The withered leaves and straw thus contain a much greater percentage of iron in the ash than the active or live parts of the plants, indicating that iron, like silica, is not transported or leached out from the dead tissue to the same extent as the other mineral elements.

4. Previous to flowering the percentages of dry matter in the green plant and of ash in the dry matter seemed to be influenced by the effect of the weather on the growth of the plant. Thus, with dry weather preceding the sample, the percentage of dry matter in the green plant was high and the percentage of ash low.

277 - **A Method of Prophesying the Life Duration of Seeds.** — CROCKER, W. and GROVERS J. F. (Department of Botany, University of Chicago) in *Proceedings of the National Academy of Sciences*, Vol. I, No 3, pp. 152-155. Baltimore, March 1915.

The loss of viability of stored seeds has been attributed to exhaustion of reserve food and degeneration of digestive and oxidising enzymes. Both food and and enzymes, however, are present in full force for some years after viability is lost. The writers suggest that, since the viability decreases with rise of temperature and moisture content of the seed, it is due to a slow coagulation of the proteins of the plasma of the embryo.

CHICK and MARTIN have shown that the coagulation temperature of proteins is not a fixed point but a function of duration of heating, percentage of water present and the reaction of the protein. BUGLIA established a time-temperature formula for the coagulation of protein : $T = a - b \log Z$, in which $T$ = temperature, $Z$ = time in minutes and $a$ and $b$ are constants

The writers have made germinating tests at different temperatures

showing that this formula is applicable as a temperature-life duration formula for seeds. The seeds of Turkish Red wheat were used.

Several factors limit the application of this formula, viz:

1) Increase of acidity of the seed hastens coagulation of the cell proteins, as occurs in seeds of *Rosaceae*.

2) A redispersal of cell proteins takes place coincidently with coagulation in active plant cells. At higher temperature coagulation is more rapid and redispersal less prominent. Low water content also diminishes redispersal of proteins so that this formula may only apply to seeds of low water content or only under conditions of fairly high temperature.

This theory shows possibilities of throwing light on the nature of loss of viability in seeds and of leading to a quantitative statement of the significance of various storage conditions (especially moisture and temperature) upon the longevity of seeds.

278 - **The Effect of Green Manures on the Germination of Various Seeds.** — FRED E. B. (Society of American Bacteriologists, V, Iudustrial Bacteriology). — *Science*, N. S., Vol. XLII, No. 1079, p. 318. Lancaster, Pa., 1915.

When green manures are turned under and the soil planted immediately a decrease in germination may result. This problem was considered of sufficient importance to warrant a series of field and laboratory experiments in an endeavour to find some explanation for this phenomenon. The causes that might be offered to account for the harmful influence of green manures on seed germination are:

1) that the green manure not only causes a marked increase in number of bacteria but also a change in the flora;

2) that the great increase in number of bacteria results in a possible accumulation of some substance or substances, toxic to germination;

3) that the rapid multiplication of microorganisms greatly increases their metabolism.

In order to gain some idea of the practical importance of this problem, a series of field tests was conducted. The results of this work show that when green clover or oat tissue is turned under and the land planted immediately, there is a distinct decrease in the rate of germination with cotton, soy bean and hemp seed. The cereals, corn and oats fail to show any injury from green manures. After twenty-five days the injurious factor seems to have disappeared entirely. Under greenhouse conditions it has been found that small amounts = 0.25 per cent. of green manures are injurious to the germination of cotton seed. Larger amounts are more effective. The addition of calcium carbonate to the green manure fails to prevent the injurious action. The degree of retardation seems to vary somewhat with the soil type; in heavy soils green manures have their most marked effect; furthermore an increase in moisture causes a decrease in rate of germination.

When peptone and casein are added in the same nitrogen ratio as the green manure, no decrease in germination is noted. Soluble carbohydrates in amounts of 1 to 2 per cent. retarded the rate of germination, but did not cause the seed to decay as in the case of green manures.

Determinations of carbon dioxide and ammonia in green manure soils were made. Periodic analyses failed to show the presence of these in quantities great enough to account for the injury to seed germination.

279 – **The Exchange of Ions between the Roots of *Lupinus albus* and Culture Solutions containing one Nutrient Salt.** — TRUE, R. H. and BARTLETT, H. H. (Bureau of Plant Industry, Washington, D. C.) in *American Journal of Botany*, Vol. II., No 6, pp. 256-278. Lancaster, Pa, June 1915.

Previous work on the antagonism of electrolytes with regard to root growth (1) has shown that absorption is greatest in solutions containing calcium and magnesium nitrates in equimolecular proportions, but that root growth was found to be equally good in any solution which did not contain less than one molecule of the calcium salt to nine of magnesium. In more dilute solution an even lower ratio of calcium to magnesium *i. e.* 1 : 99, was found to completely overcome the deleterious effect exerted by magnesium alone. In other words, absorption and growth appear to be more or less independent phenomena. These investigations have been continued with other salts $Ca(NO_3)_2$, $CaSO_4$, $Mg(NO_3)_2$, $MgSO_4$, $KNO_3$, $K_2SO_4$, $KH_2PO_4$, KCl and NaCl and their effect on root growth in *Lupinus albus* L.

The range of concentrations used was comparable to the range from distilled water to the less concentrated soil solutions. In the case of single salts however, the range of concentration in the culture solution was greater than the range of the same single constituent among average soil solutions. In this way the reaction of the plant toward electrolytes was studied at similar concentrations to those occurring under natural conditions.

It was found that the roots of *Lupinus albus* grown in darkness in distilled water give up their salts to the water at a varying rate until the death of the plant occurs through exhaustion of the reserves. Potassium dihydrogen phosphate ($KH_2PO_4$) and potassium chloride solutions act essentially like distilled water at the concentrations studied. Solutions of potassium sulphate and potassium nitrate show slight absorption by the root but other wise differ little from the phosphate and chloride. Solutions of sodium chloride act essentially like potassium nitrate and sulphate.

Solutions of magnesium nitrate and magnesium sulphate support a slight but distinct absorption phase resulting in a net gain of salts to the plants. The more dilute solutions show a net loss of salts and the higher concentrations show a toxic action.

Calcium nitrate and calcium sulphate in all concentrations studied are actively absorbed by the roots and apparently enable the plants to retain possession of the salts already present in the tissues.

280 – **A Three-Salt Nutrient Solution for Plants.** — SHRIVE, J. W., in *American Journal of Botany*, Vol. II., No. 4, pp. 157-160. Lancaster, Pa., April 1915.

The writer discusses the relative methods of Knop's and Tottingham's culture solutions. Since these are four-salt mixtures the writer proposes a simpler solution containing three salts (monopotassium phosphate, cal-

(1) See *B.* Oct. 1915, No 1020. (*Ed*).

cium nitrate and magnesium sulphate) which do not readily precipitate. The mixture was tested in solutions of constant molecular concentration (1.75 atmosphere), but with varying proportions of the various constituents. The plants used were wheat and buckwheat and the results compared with those obtained with Knop's and Tottingham's solutions are as follows :

| Experimenter & Plant | Four-Salt Solution | | | | Three-salt Solution Shrive's (1.75 Atm.) | |
|---|---|---|---|---|---|---|
| | Knop's | | Tottingham's (wheat) | | | |
| | 2.50 Atm. | 1.75 Atm. | 2.5 Atm. | 1.75 Atm. | For wheat | For buckwheat |
| Tottingham (wheat) . | 1.00 | — | 1.11 | — | — | — |
| Shrive (wheat) . . . | 1.08 | — | 1.12 | — | — | — |
| Shrive (wheat) . . . | — | 1.00 | — | 1.16 | 1.27 | — |
| Shrive (buckwheat) . | — | 1.00 | — | 1.21 | — | 1.61 |

Thus the three-salt mixture in proper proportions is not only eminently suitable for plant growth but superior to either Tottingham's or Knop's four-salt solutions.

The best solution for wheat was as follows : $KH_2PO_4$, 0180 m., $Ca(NO_3)_2$, ·0052 m. ; $MgSO_4$, ·0150 m, in volume-molecular partial concentrations ; for buckwheat $KH_2PO_4$ ; ·0144 m ; $Ca(NO_3)_2$, ·0052 m. ; $MgSO_4$, ·0200 m.

281 – **The Secretion by the Roots of Substances Toxic to the Plant.** — MOLLIARD MARIN, in *Revue Générale de Botanique*, Vol. 27, N° 322, pp. 282-296. Paris, October 15, 1915.

With the object of determining whether the roots of higher plants are capable of secreting substances poisonous to themselves the writer made a series of cultures of peas, the roots of which were allowed to develop in distilled water, so as to eliminate the factor of the decrease of the mineral substances present in the solution. In addition, the cultures were strictly aseptic, in order to exclude the intervention of micro-organisms. The seeds were sterilised by being placed for some moments in contact with absolute alcohol and subsequently for 2 minutes in a 1 % solution of bichloride of mercury. The results obtained were evident from the 2nd crop onwards, the difference between the roots of the peas and those of the controls being distinctly noticeable. The water in which the root system of an initial pea-seedling has grown manifests distinct toxicity to a second seedling, and this occurs in the absence of all micro-organisms. After further experiments to dispose of any doubts that could possibly remain as to the method of sterilisation and of the different conditions of the experiment generally, the writer concludes that the roots of peas secrete substances having a toxic effect even upon the organ which produces them, and this oc-

curs without any bacterial intervention. As other experiments have shown that the carbonic acid produced by the roots only causes a slight difference in comparison, the decrease in the yield must be attributed to toxic substances, the action of which is not diminished by raising the temperature of the solution to 120° C. for a period of 20 minutes.

Further, the water in which the root system of the peas developed, contained organic nitrogenous substances in solution. Cultures of maize in water in which peas had been grown and *vice versa* failed to reveal any specific action on the part of the secreted substances.

282 - **Respiration Experiments with Sweet Potatoes.** — HASSELBRING HEINRICH and HAWKINS, L. A. (Plant Physiologists, Bureau of Plant Industry) in *Journal of Agricultural Research*, Vol. V, No. 12, pp. 509-517. Washington, D. C., December 20, 1915.

These experiments were performed to determine the correlation, if any, between the seasonal changes in the sugar content of sweet potatoes and their respiratory activity, and incidentally to determine whether the monosaccharids or the disaccharids of the sweet potato furnish the chief material for respiration.

The sweet potatoes were placed in a water jacketed incubator at a temperature of 30° C., and the carbon dioxide of respiration collected by drawing a carbon dioxide-free current of air through the apparatus into a solution of potash. At the end of every 24 hours the amount of carbon dioxide was determined by precipitation with barium chloride.

The amounts of moisture and sugars were determined at the beginning and end of the experiment.

The results showed that there is no general correlation between the total sugar content of the sweet potato and the respiratory activity. The respiratory activity diminished with the content of reducing-sugar, indicating some degree of correlation between these two factors, but, in different lots of the roots, seasonal changes and environmental conditions effect changes in composition which tend to obscure any such correlation.

Experiments with wounded roots indicate that the sugar content is not the limiting factor in the respiration of the sweet potato. The reducing sugars are the immediate source of respiratory material and the cane sugar when once formed does not appear to be readily utilised in the process of respiration while starch and other carbohydrates are present in abundance.

283 - **On the Relation of Root Growth and Development to the Temperature and Aeration of the Soil.** — CANNON W. A. in *American Journal of Botany*, Vol. II, No. 5, pp. 211, 224. Lancaster, Pa. May 1915.

The writer discusses the soil thermograph records made at the Tucson Desert Laboratory in relation to the growth of species having unlike root systems, viz. *Prosopis velutina, Fouquieria splendens and Opuntia versicolor.*

At a depth of 15 cms. the mean maxima in 1910 ranged from 8.1° C. in January to 34.0° C. in July and the mean minima ranged from 3.9° C. 30.8° C. for the same months. At a depth of 20 cms. the mean maxima ranged between 12.2° C. in January to 33° C. in July, whilst the mean minima were 10.0° C., and 32.2° C.

At a depth of 2.6 metres the mean maxima ranged between 16.6° C. in January and 27.2° C., in July.

The growth rates of the roots of the three species were determined in box cultures.

At all temperatures the roots of *Prosopis* grew more rapidly than those of *Fouquieria and Opuntia*, this difference being especially marked at temperatures below 20° C. and between 30° and 40° C. At a temperature of 12° C. root growth ceases in the case of the two latter species but continues in the case of the former. Thus the low temperatures of the deeper layers of the soil do not inhibit the growth of *Prosopis* and as the roots are not so restricted in the aeration relation, deep penetration results.

It appears that deeply penetrating root systems are only limited by the depth of soil, whereas shallow rooting systems are more subject to environmental limiting factors. The roots of *Opuntia* and *Fouquieria* when placed under favourable conditions grow nearly as long as those of *Prosopis*. The sensitiveness of roots to environmental conditions would appear to be an important factor in the distribution species, the species having more sensitive roots being most restricted in their distribution

284 – **A Study of the Relation of Transpiration to the Size and Number of Stomata.** — MUENSCHER W. L. C. in *American Journal of Botany*, Vol. II, No. 9, pp. 487-503. Lancaster Pa. November 1915.

Experiments were performed with *Helianthus annuus*, *Impatiens sultani*, *Pelargonium zonale*, *Phaseolus vulgaris*, *Primula sinensis*, *Ricinus communis*, *Triticum sativum*, and *Zea mays* to determine the amount of transpiration in relation to the size and number of stomata per unit of transpiring surface.

No definite relation was found between the amount of transpiration and either the number of stomata per unit of leaf surface or the length of the stomatal pore in the different species investigated.

It would therefore seem that the amount of transpiration is not governed entirely by stomatal regulation, and that the variations in the amount of water lost in different species can only be explained by a complex of several factors.

285 – **Translocation of Mineral Constituents of Seeds and Tubers of Certain Plants during Growth.** — BUCKNER, G. D. (Chemist, Kentucky, Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. V. N° 11, pp. 449-458. Washington, D. C., December 15, 1915.

The translocation of mineral matter (phosphorus, calcium, potassium, magnesium and silicon) from seeds to the parts of the seedlings was investigated in the case of *Phaseolus vulgaris*, *Zea mays* and the potato tuber (*S. tuberosum*).

The seeds were germinated under sterile conditions. Some 600 beans with perfect cotyledons were selected and grown to maturity in distilled water. The plants were then divided into roots, lower stems (4 ½ inches in height), exhausted cotyledons, upper stems (2 inches) and the leaves. The liquid remaining from the cultures was evaporated to dryness and weighed.

Another batch of 600 beans was germinated similarly but only allowed to develop the first radicle. The integument and cotyledons were carefully dried and estimated separately.

The total amount of ash in the two series of beans was well within experimental error. The percentage distribution of the various constituents in the seedlings was as follows :

| Part | Phosphorus as $P_2O_5$ | Calcium oxide CaO | Magnesia MgO | Potassium as $K_2O$ | Silica $SiO_2$ |
|---|---|---|---|---|---|
| Cotyledons (exhausted) | 47.20 | 54.53 | 45.67 | 45.07 | 40.82 |
| Roots | 7.68 | 13.72 | 6.14 | 8.72 | 19.47 |
| Upper stems | 5.78 | 3.99 | 4.62 | 6.07 | 6.90 |
| Lower stems. | 15.00 | 18.51 | 16.24 | 12.31 | 9.45 |
| Leaves | 24.34 | 10.45 | 27.33 | 27.83 | 23.46 |

It is seen that approximately 50 per cent of the total mineral matter of the cotyledons remains unused, the other half being translocated to the various parts of the plant, most of it accumulating in the leaves and lower stems. A notable amount of the calcium and silica accumulates in the roots.

Similar experiments were carried out with maize, using aluminium cups instead of paraffined tubes for the seedlings. The percentage distribution of the various constituents was as follows :

| Part | Phosphorus as $P_2O_5$ | Calcium as CaO | Magnesia MgO | Potash $K_2O$ | Silica $SiO_2$ | Iron as $Fe_2O_3$ | Alumina $Al_2O$ |
|---|---|---|---|---|---|---|---|
| Leaves | 26.38 | 30.02 | 28.71 | 35.74 | 19.84 | 2.54 | 3.44 |
| Exhausted cotyledons. | 43.24 | 43.86 | 47.04 | 20.00 | 58.66 | 49.47 | 4.88 |
| Stems | 17.44 | 13.21 | 16.82 | 21.17 | 6.41 | 22.62 | 3.08 |
| Roots | 12.94 | 12.91 | 7.43 | 23.09 | 15.09 | 25.37 | 88.60 |

With the exception of potash, 50 per cent of the mineral constituents have been translocated from the cotyledons to the several parts of the seedling. In the case of potash, nearly 80 per cent was removed from the cotyledons, half of this being transferred to the leaves. The taking up of aluminium from the cups and its storage in the roots is also of interest.

In the experiment with the potato, well cleaned tubers were allowed to sprout in a dark closet. When the tubers softened the sprouts were removed and the tubers dried and analysed.

The distribution of the mineral matter was as follows :

| Part | Phosphorus $P_2O_5$ | Calcium CaO | Magnesia MgO | Potash $K_2O$ | Silica $SiO_2$ |
|---|---|---|---|---|---|
| New sprouts . . . . . | 17.77 | 13.12 | 15.84 | 12.68 | 5.13 |
| Tuber (exhausted) . . . . . | 67.13 | 42.02 | 65.68 | 64.43 | 12.41 |

Thus, a considerable amount of the mineral matter remains unused in the tuber.

The most striking fact brought out by these results is the retention of considerable amounts of mineral matter in the seeds and tubers. This is probably due to the necessity for definite amounts of the various mineral constituents to promote the katabolic changes occurring in the cotyledon and tuber during sprouting.

PLANT BREEDING

286 – **Experiments in the Improvement of Wheat at Svalöf, Sweden.** — Nilsson-Ehle, N. in *Sveriges Utsädeförenings Tidskrift*, Year XXV, Part I, pp. 4-22, figs 1-3. Stockholm, 1915.

The writer reviews the work of the past six years on the improvement of wheat in Sweden and gives the results of recent experiments with two types selected at Svalöf, viz : " Pansar " and " Fylgia " which are well adapted to the particular climatic conditions of Scania and yield more than any other variety under cultivation.

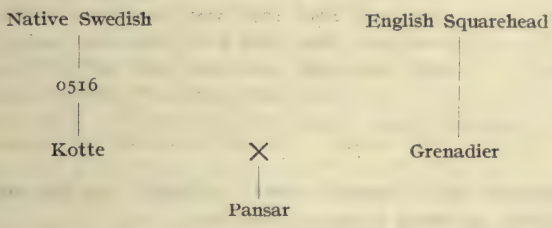
The improvement work began in 1908 with the introduction of " Extra-Squarehead II " and " Sol " which soon replaced the older varieties " Extra Squarehead I " and " Grenadier " owing to their higher yielding power, which compared with that of Native Swedish is as follows :

| | | | |
|---|---|---|---|
| Sol . . . . . | 131 | Grenadier . . . . . | 121 |
| Extra Squarehead II . . . . . | 129 | Extra Squarehead I . . . . . | 112 |
| Grenadier III. . . . . | 125 | Native Swedish . . . . . | 100 |

The improvement of wheat in Sweden is a question of how far can the caracters " yield " and " resistance to cold " be combined in the same strain. Ordinary English " Squarehead " yields in England much more than " Sol " and " Extra-squarehead II ", but owing to its less resistance to cold it yields less when planted in Sweden than the other two varieties.

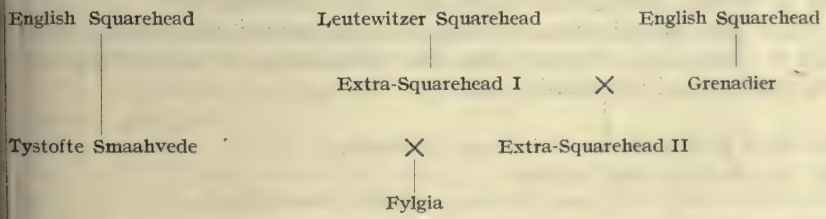
In 1907 a cross was made between " Smaahvede " and " Extra-Squarehead II " with the object of obtaining a more efficient variety combining

productivity and resistance to cold. A new type known as " Fylgia " was obtained. In 1903 the variety " Pansar " was obtained as a hybrid between " Kotte " and " Grenadier " and this has since been improved by selection. These parents in their turn were obtained from native Swedish wheat and English Squarehead, so that the origin of " Pansar " may be represented thus :




All the experiments carried out, including field experiments, have shown the type " Pansar " to be superior to the parents in combining the rust and cold resistance of " Kotte " with the high productivity, early maturity and elasticity of stem characteristic of the " Grenadier " type. In appearance it resembles more Grenadier than Kotte. The stems are vigorous, elastic and even longer than those of Grenadier and it is most distinct in its large uniformly compact ears.

" The origin of the " Fylgia " type is as follows :




" Extra-Squarehead II " is more resistant to cold and stiffer in the straw than " Smaahvede " which is a higher yielder and more rust resistant.

In combining all the characters of its parents " Fylgia " gives an average higher yield of grain but its straw is less resistant than that of " Extra-Squarehead " and is not suitable to localities where this character is necessary.

A regular series of observations was undertaken at Svalöf from 1908 to 1914 to test the superiority of the new types " Fylgia " and " Pansar " over the older types.

These observations are summarised in the following table :

| Type | Grain, lbs. per acre | | | | | | | Average yield | Average yield corrected for whole period | Average yields as percentages of that of "Pansar" |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1908 | 1909 | 1910 | 1911 | 1912 | 1913 | 1914 | | | |
| Pansar | 4 193 | 3 185 | 4 844 | 4 889 | 4 416 | 5 495 | 4 166 | 4 455 | 4 455 | 100.0 |
| Fylgia | — | — | — | — | 4 237 | 5 335 | 4 077 | 4 550 | 4 353 | 97.0 |
| Tystofte Smaahvede | 4 006 | 2 766 | 4 692 | 4 737 | 3 881 | 5 201 | 4 104 | 4 198 | 4 198 | 94.2 |
| Sol | 4 166 | 3 131 | 4 425 | 4 746 | 3 619 | 4 764 | 4 041 | 4 131 | 4 131 | 92.7 |
| Extra-Squarehead II | 4 006 | 2 908 | 4 389 | 4 710 | 3 577 | 4 907 | 3 863 | 4 051 | 4 086 | 90.9 |
| Weibulls Iduma | — | — | — | 4 291 | 4 050 | 4 889 | 3 702 | 4 233 | 3 977 | 89.3 |

The superiority of "Pansar" and "Fylgia" is also seen in experiments carried out in other parts of Sweden.

| | Malmöhus | | | | Kristianstad | | |
|---|---|---|---|---|---|---|---|
| | 1911 | 1912 | 1913 | 1914 | 1911-12 | 1913 | 1914 |
| Fylgia | — | — | 93 | 106 | — | 90 | 99 |
| Pansar | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Sol | 85 | 100 | 94 | 91 | 84 | 92 | 90 |
| Extra Square head II | 85 | 96 | 94 | 83 | 81 | (86) | 87 |

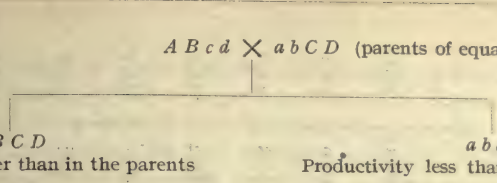
Contrary to observations at Svalöf, Fylgia gave better results than Pansar owing to the variation in the soil in the various places. In a light warm soil Fylgia gives better results than any other variety.

The following table shows the improvement made in the wheat crop at Svalöf in a comparatively short time, the values being given as percentages of the yield of native Swedish wheat :

| | | | |
|---|---|---|---|
| Pansar (Kolte × Grenadier) | 140 | Grenadier | 121 |
| Fylgia (Smaahvede × Extra Squarehead II) | 135 | Tystofte Standhvede | 121 |
| Tystofte Smaahvede | 131 | Criewener 104 | 121 |
| Sol | 131 | Vilhelmina | 115 |
| Extra-Squarehead II (Extra-Squarehead I × Grenadier) | 129 | Extra Squarehead I | 112 |
| Kolte | 128 | Native Swedish | 100 |
| Grenadier III | 125 | English Squarehead | 99 |

Only one character, for instance productivity, can be influenced by a greater number of factors than one and consequently it is possible to obtain a hybrid of greater productivity from two species of equal productivity.

This is represented in the following manner, the factors for productivity being represented by capital letters and their absence by small letters.




This raises the question as to whether the two new varieties Fylgia and Pansar are able to provide material for a still more productive type.

Experiments with this object have been in course since 1912 with hybrids Sol × Pansar, Pansar × Fylgia and Fylgia × Sol. By means of suitable selection the writer hopes to obtain a type with a productivity equal to 150 and a greater resistance to cold.

287 – **A New Strain of Rye Selected at Svalöf.** — LJUNG, ERIK W. in *Sveriges Utsädesföreningens Tidskrift*, Year XXV, Part 3, pp. 107-129, Plate 1. Stockholm, 1915.

Of the improved breeds of rye produced at Svalöf, Petkuser has rapidly taken the first place for its high yield of grain. It is also distinguished by the rigidity and resistance of the straw, which is of average length, for its rather low yield of straw and its large, compact, uniform ear. Owing to its relatively low yield of straw and its high yield of grain the percentage of grain is very high. Although the weight per 1000 grains is generally satisfactory the weight per bushel is relatively low owing to the long wrinkled grains.

With the object of isolating a strain with a shorter, smoother grain the writer began in 1904 a series of pure lines of the Petkuser variety. By successive isolations of distinct individuals with these characters, several new types were obtained, amongst which was " Svalöfs Stiärn " which differs from Petkuser by its shorter and smoother grains and by its prevailing reddish colour, while in the latter it is bluish green. Although the stem is somewhat longer it is equally vigorous and resistant, and the number of spikelets per ear is about equal in both varieties.

The relative yield of the two strains is given in the following table in pounds per acre.

This variety " Stiärn " is therefore superior to all the others including " Petkuser ". In the period 1907-1914 it exceeded the latter by 8.3 per cent with an increased yield of 299 lbs per acre, and the difference for the last 5 years is much greater, being 14.7 per cent or 476 lbs per acre. Similar experiments were also carried out at Ultuna, Alnarp, Halland and Bohus, Kristianstad, Gottland, Östergötland, Stockholm, Upsala, Örebrö, Wästmanland, Värmland.

In a total of 77 trials in different localities the variety " Stiärn " gave an average of 2864 lbs per acre or 4.9 per cent more than Petkuser which yielded on an average 2731 lbs per acre. Under favourable conditions, such as a soil not too light, it yields 268 lbs or 8 per cent more than " Petkuser ". On the other hand it is inferior in regions where the winter is severe and the soil very light. The exact localities in which this variety may replace Petkuser have not yet been determined.

In yield of straw Stiärn is superior in every case to Petkuser which,

*Yields of "Stiärn" and "Petkuser" compared with those of other strains*

| Strains | Yield of grain lbs per acre | | | | | | | | Average | Average yield of Petkuser during the same years | Average yields referred to yield of Petkuser | Percentage of yield compared with Petkuser = 100 | Percentage of grain |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1907 | 1908 | 1909 | 1910 | 1911 | 1912 | 1913 | 1914 | | | | | |
| Stiärn | 3 515 | 4 318 | 4 682 | 4 399 | 4 111 | 3 539 | 3 501 | 3 048 | 3 911 | 3 612 | 3 911 | 108.3 | 37.5 |
| Petkuser | 3 509 | 4 413 | 4 766 | 3 584 | 3 687 | 3 004 | 3 212 | 2 724 | 3 612 | 3 612 | 3 612 | 100.0 | 38.2 |
| Bretagner | 3 045 | 4 467 | 4 445 | 3 620 | 3 754 | 2 892 | 2 758 | 2 996 | 3 497 | 3 612 | 3 497 | 96.8 | 35.0 |
| Schlanstedter | 2 682 | 3 747 | 3 888 | 3 910 | 3 397 | 2 832 | 2 728 | 2 587 | 3 221 | 3 612 | 3 221 | 89.2 | 35.7 |
| Midsommar | — | — | — | — | 3 160 | 2 721 | 2 899 | 2 460 | 2 810 | 3 156 | 3 216 | 89.0 | 34.4 |
| Wasa | — | — | — | 2 944 | 2 699 | 2 371 | 2 914 | 2 394 | 2 665 | 3 242 | 2 969 | 82.2 | 32.5 |
| Prof. Heinrich | 2 516 | 3 022 | 4 059 | 3 026 | 3 071 | 2 371 | 2 966 | 2 669 | 2 963 | 3 612 | 2 963 | 82.0 | 32.2 |
| Ostgôta Grå | 2 397 | 3 444 | 3 992 | 2 944 | 2 766 | 2 379 | 2 409 | 2 438 | 2 846 | 3 612 | 2 846 | 78.8 | 32.4 |
| Probsteier | 2 480 | 3 455 | 3 776 | 3 100 | 2 795 | — | — | — | 3 121 | 3 991 | 2 825 | 78.2 | 31.2 |

however, gives a slightly higher percentage of grain, 35.9 against 35.6. This new variety, however, excels in regard to the grain characters, the weight per bushel being 58.74 lbs and that of Petkuser 57.38 lbs. With regard to the weight per 1000 grains the two varieties are equal (29.3 and 29.4 gms.) They are also equal with regard to resistance of stem and hardiness.

288 – **Mutations of Wild Species of Tuberiferous *Solanum*.** — AUMIOT J., in *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. I, No. 23, pp. 677-685, Paris November 1915.

The writer has been able to observe in various species of *Solanum* the occurrence of mutations affecting the different organs of the plant, and has shown that these species in no wise possess the immutability that has been attributed to their specific characters.

1) Thus, he found in his Anse cultures, a plant of *Solanum commersoni* Dun. which was completely transformed and had entirely the appearance of a cultivated potato approaching the " Richter's Imperator " type. Leaves very downy, of a greyish green, somewhat fluted, with 3 or 4 pairs of lateral leaflets with numerous and wide folioles; leaflets acuminate. When pulled up, this plant had 3 good tubers literally glued to the stem and inserted on successive nodes at intervals of about 2 cm. These tubers were healthy, and apparently ripe. Their shape is regular and rounded, the surface has slight protuberances, the eyes are few and not deep. The skin, which is yellow and somewhat wrinkled in places, showed on removal only slight traces of lenticels, which disappeared with time. The plant did not flower, but, judging from the complete transformation of the leaves and the underground organs, the mutation seems total and definitive. The maturity of the tubers (July 31) shows that the variety is an early one.

2) On October 9, 1914, the writer planted in a pot a very small tuber of *Solanum maglia* from the crop of 1913. His attention had been attracted by a very fine shoot which was absolutely free from all pigmentation, whereas the tubers of this species are always violet. Further, (according to P. Berthault) colour seems to be a fixed character of the tubers of wild species of *Solanum*. The first flowers opened at the end of March and, like the whole plant, presented the general characters of *S. maglia*. On taking up the plant on June 16, the writer found a single tuber, which was quite ripe, attached to the end of a very thin, withered stolon at a depth of about 18 cm. This tuber was of the size of a small walnut and round; it had few, little-developed lenticels, its colour was white slightly tinged with yellow, when removed from the ground, and it showed no subsequent sign of marked pigmentation ; the plant was therefore certainly a white *Solanum maglia*.

3) The tubers of *S. Bitterii*, which are yellow on removal from the ground, become dark violet after some days, if they are exposed to the air. Plants from tubers raised from seed sown at Marseilles in 1913, produced some tubers that turned violet after a fairly long time, and others that remained yellow till the end of April 1915 ; while one plant bore violet-pink tubers.

4) *S. commersoni*, mutation, L. Planchon, is very similar in many of

its general characters to the " Imperator " type. Its growth is, however, less vigorous, the colour of its leaves is distinctly different, its habit is less erect, it ripens earlier and is less productive. The tubers which the writer received and planted were average in size, round or more or less flattened, very regular and the eyes were superficial or of no great depth.

The shoots were violet, the skin yellow, generally smooth, but cracked in the case of some tubers.

The tubers harvested by the writer at Villeurbanne (Lyon) exactly corresponded to this description, except that their skin was much cracked. But at Anse their shape varied indefinitely, some being round, others semi-long, or even long, and more or less flattened ; one large tuber was of the " Early rose " type. Finally, the skin, which was rather wrinkled, had a somewhat dark yellow hue.

5) The tubers of wild tuberiferous species of *Solanum* are especially characterised by the lenticels of their skin which vary in their prominence and degree of development. The writer observed, in 2 cases, in 1915, similar lenticels in cultivated potatoes.

In a plantation of Bolivian varieties, his attention was attracted by a stem bearing 9 aerial tubers which were remarkable in more than one respect. The plant belonged to a variety called by the writer " Blanche allongée ". The stem when uprooted was found to bear at its base 5 underground tubers which were apparently ripe and had the peculiarity of being covered, (like the aerial tubers), with prominent lenticels similar to those seen on wild potatoes.

Other tubers kept by the writer and coming from plants derived from unidentified cultivated seed tubers are also covered with prominent lenticels resembling those observed on the tubers of the wild *S. commersoni*.

6) In 1914, a sowing of a red Bolivian variety with wheel-like corolla showed a characteristic alteration in the form of the corolla. The calyx, stamens and pistil had the characters of an *S. tuberosum*, but the corolla, which was less deeply lobed than that of *S. commersoni* for example, was nevertheless very star-shaped, the lobes being long and pointed. In 1915, the same plant, when reproduced from its first year's tubers, bore similar flowers, but the corolla was smaller.

From all these observations, the writer concludes, contrary to the usual opinion, that the wild species of *Solanum* possess no immutable characters, whether of the aerial or subterranean organs.

289 - **Selection Experiments with Timothy Grass (*Phleum pratense*) at Svalöf (Sweden).** — WITTE, HERNFRID in *Sveriges Utsädeförenings Tidskrift*, Year XXV, Part I, pp. 23-44, fig. 1-5 ; Part 4, pp. 143-182, fig. 6-24 ; Part 5 pp. 199-221. Malmö, 1915.

The writer discusses the origin and geographic distribution of this grass and describes the methods in use at Svalöf for its improvement.

The original material used for the strains was selected from wild grasses or collected in the fields at Svalöf. Each strain was then propagated vegetatively in isolated plots. These pure lines thus obtained are examined from the point of view of yield of forage. Those types which show a high

yield during a number of seasons and which show stability of characters are then reproduced on a large scale and introduced into commerce.

The chapter on polymorphism in *Phleum* and the inheritance of its various anatomical and physiological characters merits special attention.

*Length of stem.* — This varies between wide limits, from 12 or 16 to 40 inches. In some cases this character is definitely inherited, in others it appears to be very dependent upon particular environmental conditions.

*Number of internodes.* — This varies from 5 to 8. In some cases the length of the upper internode is equal to half of the total length of the stem, in others only one quarter. The length of the lower internodes also shows considerable variations. In selecting seed-bearing plants it is desirable to select types with long lower internodes and relatively short upper ones, since these characters seem to be hereditary.

In this way plants are obtained with the mass of the foliage rather high up the stem, thus facilitating the harvest and reducing the loss of forage during drought which notoriously injures the lower leaves most.

*Thickness of stem.* — Varies from one form to another and is naturally least in short stemmed plants without, however, being correlated with length.

*Position of stem.* — In some types the stem has a vertical position, in others it is more or less inclined almost to the point of touching the ground. This caracter is also hereditary.

*Tillering.* — Either open or dense.

*Dimensions of leaves.* — The size of the upper leaves varies from 0.18 to 0.42 in. in breadth and 0.67 to 6.7 in. in length. The differences are still more marked in the ratio between breadth and length ; the extreme ratio being 1 : 40.3 for leaves low down on the stem and 1 : 20.2 for the upper leaves. From the practical point of view, a large leaf surface is preferable and it is advisable to select plants with long and moderately wide leaves.

*Position of leaves.* — This may vary as much before the development of the young stems as at the flowering period. In some cases the leaves are loose and curved towards the ground whilst in others they are straight and erect.

*Ear.* — There are considerable variations in length, thickness, and compactness, etc. The length varies from 0.79 to 6 inches and the thickness (diameter) from 0.12 or 0.15 in. to 0.31 or 0.39 inches. There is no correlation between the length and thickness of the ear, nor between length of ear and length of stem. The shape of the ear is generally cylindrical but it is sometimes more or less pointed towards the extremity. In typical ears the axes of the spikelets grow into the main axis, but in certain cases the upper extremity is free from the axis. This character is also hereditary.

From a practical point of view length, and, up to a certain point, compactness of ear only are of importance in selection, the greatest quantity of seed being produced by long compact ears.

*Flowers.* — There are numerous variations especially in the shape and colour of the outer and inner glumes. In some the glumes are slightly awned.

The colour of the anthers varies from pale yellow to violet, and the weight of 1000 seeds varies between 0.21 and 0.88 gms.

*Resistance to cold.* — Some interesting observations have been made on this subject by ULANDER at ZULEA for types of *Phleum* of various sources. Thus in the spring of 1909, out of 24 types from Kalmar and Öland only 3 or 13 per cent were resistant while out of 66 from Nowbotten, 27 or 43 per cent stood well the rigours of very severe winters.

*Germination.* — Both early and late types occur, the characters of which are hereditary. There appears to be no relation between the period of germination and the time of flowering, nor between the date of flowering and that of the preceding harvest. This is also true of the *stages of flowering*, in which the difference between the early and late types may be as much as 3 or 4 weeks.

*Resistance to lodging.* — This character varies considerably and is also transmitted from one generation to another.

*Second growth.* — This character varies both in quantity and quality, in certain forms it is insignificant, in other it results only in the formation of leaf shoots, and in others again it proceeds to the formation of stems and ears.

The writer gives some information of practical importance regarding the behaviour of the glumes and pales at the period of maturation of the seeds. He recommends the selection of types in which the spikelet is easily detached from its axis, whilst the pales remain strongly adherent to the seeds thus preventing damage during the threshing.

*Resistance to Rust.* — Varies considerably and is hereditary. Thus selection and isolation of pure lines leads to improvement.

*Resistance to drought.* — The most resistant forms are naturally the dwarf types with reduced leaf system.

Owing to the great variability of the different characters, it is impossible to produce stable types. The mother plants of pure lines are always heterozygous hybrids for several characters. Therefore continued selection of the most uniform types is necessary, grouping the characters according to the object in view.

Thus for two year leys the following characters are desirable :

1) Stems straight, long and sufficiently rigid ; the upper internode should be short and the lower internode relatively long.

2) Tillering abundant and vigorous.

3) Large mass of leaves remaining green and fresh to the time of harvest.

4) Abundant aftermath.

5) Resistance to low temperatures.

6) Rust resistance.

7) Maximum growth and yield in the second year.

Types for pastures should possess the following qualities :

1) Vigorous tillering.

2) Growth rapid and abundant after pasturage.

3) Resistance to cold.

*Yields of various types.*

| Type | Average total yield | | Average yield of 1st cut | |
|---|---|---|---|---|
| | Fresh hay lbs per acre | As percentages of Swedish type | Fresh hay lbs per acre | As percentages of Swedish type |
| Saxon | 20 135 | 99.9 | 19 082 | 99.6 |
| Russian | 20 349 | 100.9 | 18 930 | 98.8 |
| Swedish | 20 161 | 100.0 | 19 153 | 100.0 |
| American | 22 356 | 101.0 | 20 322 | 97.1 |
| Swedish | 22 124 | 100.0 | 20 920 | 100.0 |

4) Longest possible duration of life.

Types for seed as well as hay should possess the following characters:

1) Ears long, rigid and compact.

2) Seeds well developed and separating easily from the glumes.

3) Tendancy to autogamy.

A series of observations was also made on the relation between the yield of hay and the meteorological factors, rainfall and temperature in particular. With the object of facilitating the comparison of the factors under investigation two periods were considered: 1) from April to the first cut; 2) from the first cut to the month of August.

The growth was more abundant as the average temperatures were lower, the rains more abundant and well distributed. Thus in 1912 from the beginning of April until July 8-11, the time of the first cut, the temperature was below normal and the rains frequent, alternating with short periods of fine weather. From July 11 to 28 drought prevailed, but from July 28 to August 31 abundant rain fell (106 mm in 23 days) and the temperature was low. In 1912 the yield of hay exceeded those of the other years which were: 16 550 lbs per acre in 1911; 12 865 lbs per acre in 1910; and 12 883 lbs per acre in 1909.

In 1914, 112.8 mm. of rain fell during the first period, of which 65.3 mm. fell in the first half of April; 26.2 mm. in May, with 12 rainy days with a maximum of 4.5 mm. in one day; 14.8 mm. in June with 8 rainy days and a daily maximum of 4 mm. During the second half of summer there were two periods of little rain: July 24-29 with 46.1 mm. and August 3-11 with 8.7 mm. The temperature was almost always above normal. In 1914 the yield of hay was very low; the 1913 leys yielded at the first cut 7805 lbs per acre with an aftermath of 937 lbs; and the 1912 leys 5085 lbs per acre.

The yields of the various selected types at Svalöf are also interesting. Thus, in all experiments "Primus Timothy" (already on the market) have an average yield 16 per cent more than ordinary Swedish *Phleum*,

but was exceeded by a new type, No. 217, which is very productive and will soon be placed on the market.

Amongst foreign varieties, the Russian, Saxony and American yield as much in the first cut as ordinary Swedish *Phleum* and give a greater second crop. The Finland type gives a first crop equal to the Swedish but its aftermath is inferior.

The following table gives a summary of the yield per acre of the first cut according to all experiments made at Svalöf.

| | | | | | | |
|---|---|---|---|---|---|---|
| 1st year | Grass | 10 919 lbs | (maximum | 16 548 lbs | minimum | 7806) |
| | Hay | 5 567 lbs | ( » | 8 439 lbs | » | 3979) |
| 2nd year | Grass | 9 545 lbs | ( » | 12 864 lbs | » | 5085) |
| | Hay | 4 871 » | ( » | 6 557 » | » | 2596) |
| 3rd year | Grass | 8 859 » | ( » | 11 098 » | » | 7654) |
| | Hay | 4 514 » | ( » | 5 656 » | » | 3907) |

AGRICULTURAL SEEDS

290 – **Comparative Researches on the Dimensions of the Seeds of Clover and Dodder (*Cuscuta*)** (1). — HEINRICH M. in *Die Landwirtschaftlichen Versuchs- Stationen*, Vol. 87, No. 4, pp. 295-408. Berlin, December 27, 1915.

The writer set himself the task of determining whether the well-known differences in the swelling property of seeds could be used as a means of distinguishing the seeds of dodder from those of clover. For this purpose he measured out a large number of seeds, 50 for each species of plant, in lots of 10 at a time, placing the lots side by side. The species studied were :

1) *Trifolium pratense*
2) *Trifolium repens*
3) *Trifolium hybridum*
4) *Cuscuta trifolia* Babington.
5) *Cuscuta racemosa* Martins = *C. suaveolens* Seringe.

The red clover came from : Mecklenburg ; Bohemia ; Austria ; Poland ; Russia ; North America and Chili.

DIMENSIONS OF AIR-DRIED SEEDS. — Measurements gave the following results :

| | Length of seed in mm. | Breadth of seed in mm. |
|---|---|---|
| *Trifolium pratense* . . . . . | 1.957 ± 0.0215 | 1.428 ± 0.0159 |
| *Trifolium repens* . . . . . | 1.220 ± 0.0056 | 1.094 ± 0.0060 |
| *Trifolium hybridum* . . . | 1.236 ± 0.0058 | 1.086 ± 0.0037 |
| *Cuscuta trifolii* . . . . . | 0.910 ± 0.0358 | 0.810 ± 0.0358 |
| *Cuscuta racemosa* . . . . . | 1.280 ± 0.0574 | 1.130 ± 0.0272 |

These figures do not differ greatly from those obtained by other observers. On examination, the figures given for red clover from the various localities are found to differ from one another as regards some characters, but these differences are often difficult to determine, on account of the large number of intermediate seeds. The largest seed was that of the Mecklen-

(1) See also B. January 1916, No. 127. (*Ed.*)

burg clover and the smallest seed that of the Russian. The seed of *Cuscuta trifolii* was obtained from a sample of Silesian clover and the *Cuscuta racemosa* seed from one of Chilian clover.

DIMENSIONS OF SWOLLEN SEEDS. — The seeds were swollen by placing them in distilled water at a temperature of 16° C. After germination they were dried and measured, when they gave the following results:

| | Length of seed in mm. | Breadth of seed in mm. |
|---|---|---|
| *Trifolium pratense.* . . . . | 2.570 ± 0.0089 | 1.823 ± 0.0066 |
| *Trifolium repens* . . . . . | 1.631 ± 0.0102 | 1.486 ± 0.0116 |
| *Trifolium hybridum* . . . | 1.708 ± 0.0079 | 1.509 ± 0.0136 |
| *Cuscuta trifolii.* . . . . . | 1.063 ± 0.0128 | 0.893 ± 0.0111 |
| *Cuscuta racemosa* . . . . . | 1.436 ± 0.0107 | 1.201 ± 0.0108 |

These results show that in *Cuscuta* seed there is less difference between the breadth of the dry seed and the swollen, than there is in clover seed, where the difference is very great.

COMPARISON OF THE DIFFERENCE BETWEEN DRY AND SWOLLEN SEEDS. — The study of the difference in the size of the dry seeds and of the swollen ones, shows that even when dry, there is a difference between the seeds of red, white and hybrid clovers and those of *Cuscuta trifolii*. Through swelling the difference in dimension is in all cases increased.

With *Cuscuta racemosa* things are somewhat different. Both the dry and the swollen seeds of red clover are larger than those of this dodder. The dry seeds of white clover and of hybrid clover are, on the contrary, smaller than those of *C. racemosa*, while the swollen seed is larger.

THE PRACTICAL USE OF THE DIFFERENCES IN SIZE AS A MEANS OF DISTINGUISHING THE TWO SPECIES OF SEED. — The observations made on the subject of the difference between the size of dodder seeds and that of clover seeds, lead the writer to conclude that it would be impossible in all cases to swell the seeds in order to distinguish them, but that in certain cases this method might give good results, if carried out as follows: the seed sample to be examined, after having been swollen according to the method described above, is first passed through a NOBBE sieve. The seeds are then dried on filter paper and examined. The seeds of dodder can thus be distinguished from the clover seeds.

## CONCLUSIONS.

1) The red clover seeds from different localities show, when dry, differences in their dimensions.

2) These differences disappear, to a large extent, when the seeds are swollen.

3) In a dry condition, the seed of *Cuscuta trifolii* is smaller than the seeds of red, white and hybrid clover.

4) When dry, the seed of *Cuscuta suaveolens* is also smaller than the

seed of red clover, but it is the same size as the seed of white and of hybrid clover.

5) Swelling increases the differences in size in the case of dry seeds of red clover and of *Cuscuta trifolii* : it also produces a difference in size between the seeds of white and hybrid clovers on the one hand, and those of *Cuscuta suaveolens* on the other.

6) By passing the swollen seeds through a sieve, it is possible to separate the clover seeds from the dodder seeds.

CEREAL AND PULSE CROPS

291 – **Report of the Committee on Home-Grown Wheat 1913-1915.** — *The Incorporated National Association of British and Irish Millers*, pp. 19, Plate I. London, October 1915.

This report contains an account of the objects of the Home Grown Wheat Committee founded in 1901 and a summary of the results obtained in the improvement of English wheats up to the present time (1).

Since some grades of flour are liable to contain a certain amount of bran powder which darkens the colour of the flour it was thought desirable to obtain a white wheat of good quality so as to diminish the colouration effect of the bran. With this object White Fife was imported from Canada, but on growing it in England it showed a partial degeneration, and subsequent selection showed that the original strain really consisted of two strains, one of which maintained its quality independently of environmental conditions, whilst the other was only able to maintain its quality under Canadian conditions.

Burgogne's Fife, a hybrid between a soft English wheat (Rough Chaff) and a hard Canadian wheat (Red Fife) has been tried extensively during recent years. As regards its baking quality it resembles neither parent, being somewhat inferior to the best Red Fife. Analysis of " Red Fife " strains shows that they are not homogeneous as regards baking qualities. Burgogne's Fife is therefore not considered to be crucial in deciding the question as to whether " hardness " in wheat is allelomorphic to " softness ".

In view of the fact that neither Red nor White Fife wheats are homogeneous as to quality of endosperm and that neither the appearance nor nitrogen content of the grain is a reliable index of its strength, the greatest importance is attached to the selection of strong parents by means of baking trials. Since, however, appearance is likely to remain the index of quality in the markets it is undesirable to produce strong wheats which appear weak or weak wheats which appear strong.

The wheat breeding investigations have been continued and crosses have been made between certain strains of Fife, both red and white, and the best English varieties, such as Square Head's Master, Browick and Rivet wheat, also with heavy yielding varieties raised in the course of other experiments.

In selecting the hybrids the chewing test is found to be the best for estimating the quality of the grain.

(1) See also *B.* August 1913, pp. 1164-1169. A. E. HUMPHRIES, Wheats from the British Millers' Point of View. (*Ed.*).

Only those types possessing the strength of the best Fife strains and the yielding power of Square Head's Master are retained.

Breeding investigations are also being carried on with Szechnan wheats with a view to obtaining short season varieties.

*Tillering experiments.* — The committee has not concerned itself with the effect of increased tillering on yield, but only with the question as to whether improved root development by drawing on the reserves of plant food in the soil affects the constitution of the grain and improves its baking qualities. Transplanting experiments were carried out and it was found that the character of the grain was considerably changed by the process. The grain of the transplanted wheat yieldéd 12.79 per cent of gluten whereas the wheat grown under ordinary conditions yielded only 9.02 per cent. On baking, however, no difference was discernible in the bread, which in both cases was poor.

*Manuring Experiments.* — Magnesia used as a manure made the grain more translucent but had no effect on the baking quality.

292 - **Japanese Rice "Sekyama" in Italy.** — NOVELLI, N. in *L'Italia agricola*, Year 52 N° 9., p. 401, 1 Plate. Piacenza, September 15, 1915.

The first experiments with this variety of rice were made in 1908 by the Director of the Experiment Station for Rice Cultivation at Vercelli and though at the present day it is not one of the most widely grown crops it has acquired a notable position in some districts, especially in the districts of Lodi, Milan and Pavia, in Lomellina and also in the province of Mantua. It grows particularly well in rather rich soils under rice for the first time.

It is of vigorous growth, disease resistant, and a high yielder. It has also the advantage of early maturity. As an early crop it is grown particularly on lands where other varieties of equal yielding capacity are late in maturing. In habit of growth it resembles somewhat a variety known as "giapponese biondo" (Japanese blond) a variety extensively grown in Italy several years ago.

From the commercial point of view, it is one of the least appreciated varieties, but on account of its productivity and high milling yield it is worthy of the greatest consideration.

293 - **Relation of Cultivation and of Number of Stalks per Hill to Yield of Maize Crop.** — BULL, C. P. in the University of Minnesota Agricultural Experiment Station, Bulletin 149, 23 pp., 7 figs., University Farm, St. Paul, June 1915.

I. — RELATION OF CULTIVATION TO YIELD AND CHARACTER OF CROP. A series of plots of equal size were laid off each year on a uniformly good piece of land. The preparation of the land for all plots was exactly the same each year. They were ploughed, disked, harrowed, marked 3ft. 6 in. each way and all the plots were planted the same day, and all the plots, except plot No. 1, were harrowed after planting according to the usual custom. The further treatment differed only in the number of cultivations given.

Minnesota N° 13 maize was sown. The experiments were repeated

in 1908, 1909 and 1910. The plan of the experiments and their results are given in Tables I and II.

TABLE I. — *Treatment of Plots after Planting.*

| Plot | Harrowed | Cultivations |
|---|---|---|
| 1. | Not at all | 1. All weeds allowed to grow |
| 2. | Once after sowing | 2 Once each way |
| 3. | » | 3. Twice one way — once the other |
| 4. | » | 4. Twice each way |
| 5. | » | 5. Three times each way |
| 6. | » | 6. Weeds kept down with hoe |

TABLE II. — *Average Results of Cultivation Experiments* 1908, 1909, 1910.

| Plot Number | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| No. of cultivations | 0 | 2 | 3* | 4 | 6 | Hoed |
| Per cent barren stalks | 25.2 | 9.7 | 21.7 | 5.8 | 5.7 | 7.9 |
| Per cent stand when cut ** | 97.70 | 84.76 | 94.50 | 93.53 | 90.80 | 94.06 |
| Height of stalk, inches | 25.5 | 34.5 | 33.0 | 38.5 | 35.5 | 36.0 |
| Per cent of marketable ears by weight | 0 | 58.0 | 43.0 | 53.0 | 48.0 | 49.0 |
| Yield of maize per acre, bushels | 9.02 | 45.69 | 48.15 | 59.07 | 62.71 | 64.17 |
| Yield of stover per acre, pounds | 2 066 | 3 210 | 3 750 | 3 896 | 3 931 | 3 761 |
| Average yield of maize per acre 1909 and 1910, bushels | 3.32 | 48.93 | 48.10 | 59.27 | 58.76 | 60.94 |
| Average yield of stover per acre 1909 and 1910, pounds | 2 054 | 3 741 | 3 750 | 4 403 | 4 871 | 4 115 |
| *Cost; Profit and Loss.* | | | | | | |
| Value of crop § | 4 329 | 21 931 | 23 112 | 28 350 | 30 100 | 31 80c |
| Cost of production (exclusive of cultivation and husking) » | 11 799 | 11 799 | 11 799 | 11 799 | 11 799 | — |
| Cost of husking » | 631 | 3 198 | 3 360 | 4 134 | 4 389 | 4 49² |
| Cost of cultivation » | — | 974 | 1 461 | 1 948 | 2 922 | — |
| Total cost of production » | 12 430 | 15 971 | 16 620 | 17 881 | 19 110 | — |
| Profit » | — | 5 960 | 6 492 | 10 469 | 10 990 | — |
| Loss » | 8 101 | — | — | — | — | — |
| Increased profit by cultivation » | — | 14 061 | 532 | 3 977 | 521 | — |

* A two-year average 1909-1910.

** Compared with number left after thinning, namely three per hill.

The above data show: 1) that to a certain degree, the lack of cultivation is attended by an increased percentage of barren stalks. 2) Though the "twice-cultivated" plot is an exception, the increase in the number of cultivations seems to have a tendency to lower the percentage of stand. The difference, however, is not sufficient to warrant definite conclusions. 3) The height of the stalks and of the ears on the stalk does not appear to be influenced by the cultivation, except that with no cultivation they are considerably lower. 4) The yield of maize and of stover per acre is materially affected by the number of cultivations. 5) It is plain that two cultivations are not sufficient to subdue the weeds ; on the other hand it appears that it is not necessary to practice deep tillage when once the soil has been properly prepared before seeding. The average yield of the hoed plot exceeded the highest yield obtained from any other. Whether, however, from an economic standpoint, more than four cultivations would be warranted, would have to be determined by local conditions. Thus, for instance, in years of severe drought the extra work would be profitable. According to data gathered and compiled by the Section of Cost Accounting, maize cultivation operations cost, on the average, 48.7 cents per acre.

TABLE III. — *Result of Experiment on Number of Maize Stalks per Hill, Averages of Five Years* 1906-11.

| Desired stalks per Hill | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Total stalks per plot . . . . . | 541.0 | 427.0 | 635.0 | 866.0 | 1 090.5 | 1 360.0 |
| Barren stalks . . . . . | 17.0 | 17.30 | 33.60 | 96.33 | 194.33 | 298.33 |
| Per cent barren stalks . . . . . | 3.0 | 4.21 | 5.93 | 14.30 | 21.35 | 23.15 |
| Per cent stand when cut . . . . | 99.70 | 94.55 | 93.67 | 93.67 | 94.60 | 93.85 |
| Height of stalk, inches . . . . . | 82.30 | 80.60 | 81.00 | 78.33 | 78.33 | 74.33 |
| Height of ears . . . . . | 35.60 | 34.60 | 35.00 | 31.66 | 32.00 | 30.00 |
| Weight of ears per plot, pounds | 404.0 | 392.0 | 516.8 | 525.7 | 507.9 | 418.2 |
| Weight of marketable ears, pounds | 244,83 | 275.95 | 288.75 | 247.75 | 187.87 | 129.25 |
| Per cent of marketable ears. . . | 82.07 | 81.40 | 66.37 | 54.45 | 38.75 | 30.37 |
| Total gross weight of maize per plot, pounds . . . . . | 805.0 | 745.6 | 984.3 | 1 034.7 | 1 052.9 | 998.2 |
| Yield of maize per acre, bushels | 50.57 | 42.90 | 58.15 | 55.92 | 53.92 | 44.66 |
| Yield of stover per acre, pounds * | 3 529.83 | 2 827.87 | 3 598.90 | 3 830.47 | 4 304.47 | 4 663.47 |

(*) The results of 1911 are not included

II. — RELATION OF THE NUMBER OF STALKS PER HILL TO YIELD. This experiment proposed to ascertain the most advantageous number of maize stalks per hill. An enquiry made among the best maize growers of Minnesota showed that the desired number of stalks per hill varies from

2 to 4. The number preferred in most cases is 3, and the general average is 3.08.

The plan of the experiment conducted by the writer provided for a series of 6 plots to be planted annually to Minnesota N° 13 maize on land of uniform quality, and treated in the same way, only the number of stalks per hill should vary from 1 to 6. To secure the desired stand, from 2 to 3 extra seeds were sown per hill. When the plants were about 6 inches high they were thinned to the desired number of plants. The results of the experiment are set forth in Table III.

The above results show: 1) that not only the number but also the percentage of barren stalks increases as the number of stalks per hill increases.

2) that the common assumption that thicker planting results in greater loss in the number of stalks per hill is not borne out;

3) that the increased number of plants per hill has an adverse effect upon growth;

4) that the same conditions also prevail and to a greater degree in the height of the ears on the stalks;

5) that the maximum yield per acre was reached with 4 stalks per hill, while 3 stalks per hill yielded only a fraction of a bushel less and that 6 stalks per hill yielded more than 2 stalks per hill;

6) that in the yield of stover 6 stalks per hill gave the highest production per acre. The yield of stover increased as the number of stalks per hill, except for the drill row, which yielded practically the same as 3 stalks per hill.

Under the soil conditions obtaining at University Farm, from 3.3 to 4.5 square feet of soil area per plant is sufficient under average conditions for maximum production. How far these results hold good for other localities is not known, but in general it may be concluded that three or four viable seeds per hill and a resulting stand within the limits of 10 per cent will produce the largest yield of corn and a relatively high production of stover. For the production of ears 3 stalks per hill will give most satisfactory results. If, on the other hand, it is desirable to feed the crop in the bundle to cattle, 4 stalks per hill would be preferable.

294 – **The Importance ef Thick Seeding in the Production of Milo Sorghum in the San Antonio Region, Texas.** — HASTINGS, STEPHEN H. in Bulletin of the Department of Agriculture N° 188, 21 pp. 9 figs. Washington D. C. 1915.

Experiments carried out at the San Antonio Experiment Farm (Texas) since 1909 and the results obtained by farmers in that neighbourhood indicate that grain sorghum can be made a highly satisfactory grain crop in the San Antonio region if the proper varieties are grown and the necessary cultural methods are followed.

It appears that unsatisfactory yields are due in many instances to thin stands, which permit excessive tillering and this results in delayed and non uniform maturity, and this is especially harmful as the successful production of sorghum depends upon the crop getting past the flowering stage before the appearance of the sorghum midge (*Contarinia sorghicola* Coq.).

Experiments with milo were conducted at the San Antonio Experiment Farm in 1913 and 1914 to determine the effect of planting in rows at different distances apart and of thinning the plants to different distances within the rows, on the tillering and branching, the uniformity and date of ripening and the yield.

The season of 1913 was very favourable for the production of grain sorghum whereas 1914 was particularly unfavourable.

The results of the experiments were as follows:

Varying the distance between the rows did not cause marked differences in the number of tillers or the number of heads per plant.

With distances between the rows varying from 36 to 48 inches the average number of mature heads per plant ranged from 2.2 to 2.8 in 1913 and from 1.04 to 1.08 in 1914.

In the plots on which milo was sown in rows 4 feet apart and where the plants were thinned to different distances within the row the number of heads per plant decreased consistently as the spacing within the row decreased; the yield, however, increased slightly as the plants stood in thicker stands. Thus in 1913 the rows that were not thinned and those thinned to 2 inches apart yielded 46.4 bushels per acre, while those thinned to 18 inches apart yielded 42.5 bushels per acre. In 1914 the rows not thinned gave 21.8 bushels per acre and those thinned to 24 inches only 1.2 bushels per acre.

On May 15, 1913, counts were made of the number of stalks per row and per plant and at harvest time the number of heads per plant on the same plots was determined. It was observed that there was a decrease in the number of stalks per plant where the plants were crowded and that the reduction of tillering is advantageous to the yield. The crowded plants, in 1913, ripened about one week earlier than the widely spaced plants. This early maturity is particularly important in that it permits the crop to escape the sorghum midge.

The weather conditions influence very markedly the number of tillers and branches produced, although the total number of branches and tillers produced in 1914 about equalled the total number of tillers alone in 1913, when there were but few branches.

In practice the stand is controlled by varying the rate of seeding rather than by thinning the plants. The writer recommends sowing 5 to 6 pounds per acre where the rows are 4 feet apart.

It would appear that the close spacing of the plants can be practised in sections of low rainfall. To offset this increase in the number of plants per row it is necessary only to increase the distance between the rows.

The time the plants are thinned does not seem to be an important factor in suppressing tillers and branches. If the thinning is delayed sufficiently to reduce tillering, there seems to be a tendency for the plants to increase the number of branches.

FORAGE CROPS. MEADOWS AND PASTURES

295 – **Cultural Experiments with *Bromus arvensis* L. at Svalöf, Sweden.** — Witte Hernfrid in *Sveriges Utsädeförenings Tidskrift* Year XXV, Part. 5, pp. 244-248. Stockholm, 1915.

When grown as a single crop this grass yields in the first cut more than any other forage plant. The yield of the second cut depends on the meteorological conditions and the period of the harvest. At Svalöf in 1912, the first cut yielded 9 456 lbs. of grass per acre (3 791 lbs of hay) and in 1913, 8 029 lbs per acre. In these two years the crop was mown late (10-12 July) and there was almost no aftermath. In 1915 the first cut made on June 28, well in advance of the flowering period, gave 20 072 lbs. of green fodder per acre and an aftermath of 11 508 lbs. This good yield was partly due to the fact that the first harvest was followed by abundant rain, 7.6 inches falling in 24 days. Thus this grass even when sown alone gives excellent results when the weather is damp and fresh.

Mixtures of *Bromus* with other forage crops in 4 different combinations were sown at the rate of 1.8 lbs per acre. The results of these various combinations were as follows :

| Combination. | Amount of seed sown in lbs per acre. | | | | | | | | Yield of hay in lbs per acre. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Clover. | | *Trifolium hybridum* | *Phleum pratense* | *Dactylis glomerata* | *Festuca pratensis* | *Avena elatior* | *Bromus arvensis* | Total of all plants. | | | Of *Bromus* alone | | |
| | Early Red Silesian | Late Red Swedish | | | | | | | 1st cut | 2nd cut | total | 1st cut | 2nd cut | total |
| I . . . | 8.9 | — | 1.78 | .89 | 3.56 | 3.56 | 1.45 | 1.78 | 5 642 | 1 968 | 7 610 | 2 668 | 230 | 2 898 |
| II . . . | 8.9 | — | 1.78 | — | 7.12 | — | — | 1.78 | 5 440 | 2 048 | 7 488 | 3 688 | 229 | 3 917 |
| III . . . | — | 8.9 | 1.78 | 4.45 | 2.67 | — | — | 1.78 | 5 793 | 1 838 | 8 631 | 2 561 | 136 | 1 697 |
| IV . . . | — | 8.9 | 1.78 | — | 7.12 | — | — | 1.78 | 6 726 | 2 003 | 8 729 | 2 179 | 132 | 2 311 |

Thus, the yield of the *Bromus* alone at the first cut is equal to 45.7 per cent of the entire crop whilst in the second cut it falls to 9.4 per cent On the whole the yields of *Bromus* from 1.78 lbs of seed are very satisfactory.

296 – ***Panicum sanguinale*** **or False Cebadilla, a Wild Forage Plant in Paraguay** — Bertoni, Guillermo Tell. in *Boletín del Departamento Nacional de Fomento*, Vol. I. N° 8-9, pp. 104-105. Asunción, Paraguay, 1915.

*Panicum sanguinale* is one of the best wild forage plants in Paraguay It is an annual of rapid growth and spreads rapidly. It succeeds on the most diverse types of soil, but not in low inundated lands or very dry, sterile soils. The forage is tender, palatable and of great nutritive value and very suitable for making hay which is very compressible. The young plant contains about 80 per cent of water and in the dry state its percentage composition is as follows :

| | | | |
|---|---|---|---|
| Ash | 17.23 | Fat | 2.84 |
| Total nitrogen | 3.32 | Cellulose | 26.11 |
| Protein | 20.75 | Carbohydrates | 33.32 |

Although this plant is an excellent forage when obtained as a wild crop, it can hardly be recommended for cultivation on account of its spreading character, lack of resistance to treading down, and difficult harvesting. Also on account of its high moisture content it cannot be fed green.

297 - **Custom Ginning as a Factor in Cotton Seed Deterioration**. — SAUNDERS, D. A and CARDON, P. V. in *U. S. Department of Agriculture, Bulletin* N° 288, 8 pp. 5 figs., Washington D. C., September 1915. FIBRE CROPS

The admixture of cotton seed is largely responsible for the rapid deterioration of cotton varieties which is so apparent throughout the cotton belt, and which to a large extent is directly traceable to the mixing of seed at the custom gins. To measure the degree of mixture a method was devised by one of the writers, Mr. SAUNDERS, at Greenville, Texas. The results obtained showed that in practice, unless special precautions be taken, mixing of the different lots of seed cotton that successively pass through the gins occurs in several parts of the machine : in the flues which convey the seed cotton to the distributing, cleaning and feeding devices and in these latter also, though only slightly. Extensive mixing takes place in the roll box and it was found that the seed corresponding to one bale of lint, obtained by ordinary ginning, frequently contained 14 to 16 per cent of the seed of the lot previously ginned and also a small quantity from the lot that preceded the latter.

This means that if different varieties are being ginned consecutively a patron will receive in the seed delivered to him at the gin an admixture of at least three varieties. If such seed is planted opportunity is offered for a vast amount of cross-fertilization in the field and deterioration begins. During the next ginning one or more other varieties may be added and in a few years an improved variety may completely deteriorate.

In order to minimize the amount of mixing the following precautions should be taken :

The flues, feeders, and cleaners should be thoroughly cleaned before seed cotton is allowed to enter them. The roll should be dropped from the roll box and the box should be thoroughly cleaned. The next step is to prevent the seed from falling into the conveyor. It is impracticable to clean the conveyor satisfactorily and therefore it should not be used when planting seed is to be obtained. By adjusting the position of the apron of each gin the seed can be made to fall upon the floor instead of into the conveyor. From here it can be sacked easily. The floors about the gins should be cleaned and canvas is often spread on the floor to receive the seed.

Such precautions require time and will increase somewhat the cost of ginning, but the advantages gained will amply compensate the extra cost. The expense of special ginning may be reduced by arranging to have it done at the close of the season when more time is available.

298 – **Seasonal Variations in the Storage of Plant Food in *Hevea brasiliensis* and their Relation to Resting Periods.** — CAMPBELL L. E. (Rubber Research Chemist) in *Department of Agriculture, Ceylon, Bulletin No. 22*, pp. 1-18, Diagr. I-VI. Colombo, September, 1915.

Investigations on the question of seasonal variations in the movements of plant food were begun in November 1913 in view of the importance of the subject in its bearing on the cessation of tapping during the period of leaf change. Six trees were selected out of a row of 39 untapped trees of average girth (25.9 inches at 3 feet) and the method of examination was by means of the starch-iodine test of sections of bark and wood as used in former investigations (1).

No considerable variation was found in the amount of starch stored in the bark and wood from November up to the time of leaf-fall in March. When the trees were leafless the amounts of starch stored in the bark and wood showed no signs of decreasing, but a large withdrawal of starch from the bark and wood to a depth of ½ inch from the cambium was observed when the new leaves were attaining their full size. Recovery of starch began within three weeks of the time that the new leaves were fully formed and this recovery continued until June.

Twenty three of the trees in this row were tapped continuously during the experiment and yielded rubber as follows :

| | Grammes | | Grammes |
|---|---|---|---|
| November | 7.44 | May | 6.69 |
| December | 7.88 | June | 7.15 |
| January | 10.73 | July | 7.88 |
| February | 7.64 | August | 7.88 |
| March | 4.47 | September | 9.47 |
| April | 4.03 | October | 8.89 |

Leaf-fall occurred during February and the trees were bare during the first and second weeks of March. New leaf formation continued until the end of April. The decrease in yield during March, April and May corresponds to the amount of starch found in the wood and bark during these months.

In Ceylon the general practice with regard to tapping during the leaf-fall period is as follows :

1. Most estates cease tapping for some period whilst the trees are changing foliage.

2. The period of rest generally extends from the time of leaf-fall to the time of full development of the new leaves and is usually from 4 to 6 weeks.

These investigations show that the recovery does not begin until one or two weeks after the full development of the leaves and even then the reserve food supply is not sufficient to justify a recommencement of tapping (2).

(1) See *B.* Sept. 1915, No. 917. (*Ed.*).
(2) See also *B.* Dec. 1915, No. 1287. (*Ed.*).

Thus it appears that the rest period in Ceylon occurs too early. The most suitable time is from the appearance of the new leaves until 3 weeks after the full development of the foliage has been obtained.

299 — **Experiments Made in Denmark on the Seed Time of Sugar Beets** (Meddelelser fra Statens Forsøgsvirksømhed i Plantekultur, 59) — *Tidsskrift for Planteavl*, Vol. 22, Part. 4, pp. 714-715. Copenhagen, 1915. SUGAR CROPS

These experiments were made during 1909-13 at the Experiment Station at Abed (Lolland, Southern Denmark) on a loam soil previously under wheat.

The average results are summarised in the following table :

*Average yields of Sugar Beets sown at different periods* 1908-1913.

| Time of sowing | Yields per acre | | Sugar Content | No. of plants flowered in 1st Year |
|---|---|---|---|---|
| | Beets | Sugar | | |
| | lbs. | lbs. | per cent. | per cent. |
| 10th April | 32,474 | 5,977 | 18.4 | 10.7 |
| 22nd April | 32,653 | 5,977 | 18.2 | 2.0 |
| 4th May | 30,601 | 5,710 | 18.7 | 0.3 |
| 16th May | 27,668 | 5,085 | 18.4 | 0.1 |

From these results it follows that mid-April is the most suitable time for preparing the soil for sowing about the 20th of the same month. Further north it would be better to postpone sowing till some days later.

300 – **Loss in Tonnage of Sugar Beets by Drying**. — SHAW, HARRY B. (Assistant Pathologist, Cotton and Truck Disease and Sugar-Plant Investigations) in *Bulletin of the U. S. Department of Agriculture*, N°. 199, 12 pp., 5 figs., Washington 1915.

DRYING OF BEETS PULLED BUT NOT TOPPED. — At Odden, Utah, October 17, 1912, the writer dug and pulled several rows of beets. The beets were at once weighed (10 a.m.) then again at 1.50 p.m., at 5.30 p.m. and at 10 the next morning ; between each weighing they were spread out on the ground. It was found that in the 24 hours the beets had lost 10.32 per cent of their weight, namely 7.1 per cent between the first and the second weighing, 2.8 per cent between the second and third and 0.42 per cent between the third and fourth. During this experiment the mean temperature was 53.29° F.

DRYING OF BEETS PULLED, TOPPED AND LEFT IN RATHER SMALL PILES. — The same morning four other rows of beets were dug, pulled and topped as rapidly as possible. The tops and beets were weighed separately. The beets were thrown in small open piles according to a common practice of beet growers and the tops were laid in a single windrow. The mean temperature during this experiment was 50° F. The experiment was repeated on the following day, the mean temperature during this experiment was 52° F. The results were as follows :

1st Experiment:

| | | | | | | |
|---|---|---|---|---|---|---|
| Roots. Loss per cent in weight from | 10.35 | a. m. | to | 2.15 | p. m. | 0.54 |
| Tops. » » » | 10.20 | a. m. | to | 2 | p. m. | 12.8 |
| » » » » | 2 | p. m. | to | 5.30 | p. m. | 9.4 |

2nd Experiment:

| | | | | | | |
|---|---|---|---|---|---|---|
| Roots. Loss per cent in weight from | 11.00 | a. m. | to | 5.30 | p. m | 2.42 |
| Tops. » » » » » » » | | | | | | 10.90 |

THE DRYING OF BEETS PULLED, TOPPED AND LEFT IN PILES OF MEDIU SIZE. — On October 17,1912, at Ogden, several other rows of beets were dug topped and thrown into two piles of medium size after being weighed These were then weighed again at intervals. The mean temperature durin this experiment was 43.25° F.

A similar experiment was carried out at Garden City, Kansas and laste from November 10th. to 14th. The temperature ranged between 6 and 4° F.

The losses during 24 hours in the first experiment amounted to 4.7 per cent. and in the second 6.48 per cent (average of two series of experi ments lasting four days).

THE DRYING OF BEETS PULLED AND PILED WITHOUT BEING TOPPED. — Simultaneously with the experiments at Garden City other series of beet were thrown into piles without topping them. The mean daily loss i weight was 7.9 per cent (average of two series for four days).

THE DRYING OF BEETS PULLED, TOPPED, THROWN INTO LARGE PILE AND LEFT FOR SEVERAL DAYS. — On October 14,1912, a plot of sugar beet was dug with a special beet plough. As rapidly as possible the beet were pulled and topped and weighed (deducting the tare due to adherin soil which had been determined on a sample weighing about 100 lbs.). The were then piled in two piles of about 500 lbs. each and left uncovered i the open field for five days. The mean temperature during the experi ment was 47° F.

At the same time another pile similar to the above was made but co vered with beet tops. The results were as follows :

| Uncovered piles | Series 1 | Series 2 |
|---|---|---|
| Loss of weight in 24 hours, per cent | 3.59 | 2.21 |
| » from 1st to 2nd day | 4.53 | 3.24 |
| » » 2nd to 5th | 6.94 | 8.69 |
| Totals | 15.06 | 14.14 |

| Covered piles | | |
|---|---|---|
| Loss of weight in 14 hours, per cent | 0. 54 | 0.71 |
| » from 1st to 2nd day | 0.885 | 0.93 |
| » » 2nd to 5th | 2.775 | 3.21 |
| Totals | 4.180 | 4.85 |

Thus in the large uncovered piles the mean daily loss during the first five days was 2.92 per cent, and in the covered piles 0.9 per cent. These losses are smaller than in the case of small piles or when the beets are spread on the field.

EFFECT OF DRYING UPON THE SUGAR CONTENT OF BEETS. — From some beets taken from a silo a diagonal core was rasped out for analysis. The next day a similar core was rasped out after the beets had been exposed for 4 ½ hours to a brisk current of air. It was found that the percentage of sucrose increased as the water was withdrawn by evaporation and that some inversion and decomposition took place even during so short a period as about 30 hours, the time covered in this series of tests. This inversion is insignificant when the delivery of the beets is delayed from 1 to 3 days after they have been dug and topped, but it should receive consideration when the farmer has to silo his beets for weeks or months.

THE DRYING OF SUGAR BEETS IN VERY LARGE OPEN PILES. — About 57 tons of beets were placed in three adjacent piles, containing respectively 11 tons 900 pounds, 16 tons 1 700 pounds, and 28 tons 190 pounds. This was done at Ogden during November 3, 4 and 5, 1912. They were left undisturbed until January 4, 1913 when they were again weighed. During the two months they lost 4.1 per cent. The mean temperature during the entire period was 36.72° F., and the rainfall 1.42 inches.

301 – **Effects of Attacks by *Cercospora beticola* on the Composition of Sugar beets.** — See N° 357 of this *Bulletin*.

302 – **Method of Drying of Kentucky Tobacco.** — BENINCASA M. in *Ministero delle Finanze, Direzione Generale delle Privative, Bollettino tecnico della Coltivazione dei tabacchi pubblicato per cura del R. Istituto sperimentale in Scafati (Salerno)*, Year XIV, Nos 5-6, pp. 173-181. Scafati, September-December 1915.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL CROPS

Some Italian tobaccos even after the most careful drying tend to absorb moisture from the air. This hygroscopicity of leaves may result in reducing their value and their suitability for the making of fermented cigars.

This hygroscopicity varies with different tobaccos, some being able to absorb 22 per cent of moisture without deterioration, whilst others deteriorate with 10 per cent of moisture. As a general rule, it may be said that from 17 to 18 per cent of moisture may be retained without deterioration by most tobaccos but that 20 per cent should not be exceeded even in the most resistant tobaccos.

By a rational drying method the tobacco is dried to a degree exceeding that required, but before packing the tobacco is liable to absorb an excess of moisture equal to 22-23 per cent or more.

With a view to a study of a method of reducing the humidity of 17-20 per cent, according to the variety, the writer summarises the conclusions of his observations made in all parts of Italy during the past 20 years.

1) Certain Italian Kentucky tobaccos require, in addition to careful natural drying, artificial drying immediately before being packed.

2) After artificial drying it is necessary to produce an artificial reabsorption of moisture until the leaf tissue becomes supple whilst the midrib remains dry.

3) Tobacco when thus treated not only keeps better but also is more acceptable to the consumer.

4) The cost of this additional treatment is largely compensated by the higher price obtained.

303 – **New Experiments Carried out in 1914 at the Medicinal Plant Experiment Station at Kolozzsvár (Hungary)** (1). — I. PÁTER BÉLA in *Kisérletugyi Közlemények* (Bulletin of the Agricultural Stations of Hungary) Vol. XVIII, Part. 3, pp. 639-657. Budapest 1915. II. *Idem* « On the Degeneration of the Species of Mint Cultivated in Hungary ». *Ibidem*, pp. 625-638, 8. figs.

I. — *The continuation of experiments on :*

1) The cultivation of roses for essential oil ; 2) sowing delicate medicinal plants ; 3) artificial propagation of *Claviceps purpurea ;* 4) artificial manuring of *Mentha crispa* ; 5) the acclimatisation and manuring of " Mitcham " peppermint (*Mentha piperata*) imported from England ; 6) the acclimatisation of Japanese mint ; 7) manurial experiments with *Melissa officinalis ;* 8) manurial experiments with *Cnicus benedictus.*

These experiments have established the following facts :

1) Many species of roses grown for essential oil, *Rosa damascena trigintipetala, Rosa centifolia, Rosa moschata* and *Rosa rugosa* were cultivated in the open. The last of these varieties gave much the best results, because it was the most easily propagated.

2) Many plants with minute seeds that have hitherto been sown in nurseries, succeeded well in the open ; these were : *Digitalis purpurea, Origanum Majorana, Inula Helenium, Rheum* sp., *Salvia officinalis, Salvia Sclarea, Valeriana officinalis, Pyrethrum cinerariaefolium.* The autumn sowings of *Hyoscyamus* and *Datura Stramonium* succeeded better than the spring sowings which were generally a failure.

3) Experiments on the artificial propagation of ergot (*Claviceps purpurea*), were successful when the sclerotia were sown in the autumn in the open ; when they were cultivated indoors the spores did not germinate. Of the sclerotia sown, only those buried in the ground to a depth of from 2-3 cms. germinated, any sown at a less depth, or on the surface of the soil, did not germinate. On a plot of 2 sq. metres, ergot was obtained by artificial infection on 160 ears of rye.

4) The manurial experiments with *Mentha crispa* (Curled mint) gave excellent results : a 40 % potassic fertiliser applied alone increased to a considerable extent both the green crop and the yield of essential oil. The essential oil of plants manured with potassic fertiliser alone was much clearer and more plentiful than that obtained from plants for which phosphatic and nitrogenous manures had been used, whether applied separately, or mixed.

5) The experiments made with the Mitcham variety of English peppermint were very successful. This variety gave better results than *Mentha Agnielliana.* The manurial experiments proved that a mixture of phosphatic, nitrogenous and potassic fertilisers increased the yield most.

See : *B.* December 1913, N° 1345 ; *B.* January 1914, pp. 27-31 « The Cultivation of Medicinal Plants in Hungary » by Dr Béla Páter. (*Ed.*)

6) The experiments in acclimatising Japanese mint gave very satisfactory results. The total amount of menthol obtained from the plant grown at the Station was 81.12 per cent., while the essential oil produced was equal to the Japanese oil called "Torioroshi". Crystals of menthol were even obtained from it.

7) Manurial experiments have shown that balm *Melissa officinalis*, derives much benefit from a complete fertiliser. While a plot of 514 sq. yds. manured with a compound of phosphatic, nitrogenous and potassic fertilisers yielded a return of 136 lbs, the control plot of the same area only produced 64 lbs of dry plants.

8) The manurial experiments with Blessed Thistle (*Cnicus benedictus*) showed the efficacy of nitrogenous fertilisers.

II. — *On the degeneration of the species of mint cultivated in Hungary.* In growing varieties of mint one of the most important questions is that of their degeneration. This, as is known, occurs very easily, and changes both the habit and the composition of the plants. The Medicinal Plant Experiment station which has been engaged in growing different varietes of mint for some years, has observed the following facts :

1) Curled Hungarian mint has shown itself very stable, both as regards its external characters and its composition. The cultivation of a single variety for 19 years has given rise to no modifications in its characters. This constancy of form, together with the absence of retrogression in intermediate characters, permits of the conclusion that the Hungarian curled mint is not a hybrid, but a variation of *Mentha spicata* Huds., which has been improved by cultivation.

2) The *Agnielliana* variety of *Mentha piperita* easily degenerates ; the writer gives several photographs showing cases of degeneration. These cases of degeneration have allowed of the recognition of the intermediate forms of *Mentha aquatica*, of *M. viridis* and *M. verticillata*. In all probability *Mentha piperita Agnielliana* is a hybrid of these varieties.

3) The "Mitcham" English peppermint grown at the Station since 1912 seems to belong to the *M. verticillata* type ; but forms of *M. aquatica* have been observed among degenerate plants, hence it appears that the English peppermint is also a hybrid, as it often reassumes the parental characters.

4) The Japanese mint grown at the Station since 1911 only showed degeneration in the colour of the stem and leaves, which varied between light green and dark reddish brown. The inflorescence has shown itself to be very constant and has the characteristic form of *M. arvensis ;* it is consequently doubtful whether Japanese mint is a product of hybridisation.

304 - **Intensive Cultivation of Pineapples with Citrus in Queensland.** — *Queensland Agricultural Journal*, Vol. 4, Part. 5, pp. 280-281. Brisbane, November 1915. MARKET GARDENING

The following yields were obtained at Woodford Queensland, in the third year from 2 acres of pineapples ("Rough pine") interplanted with oranges and mandarins :

| | Cases | Weight | |
|---|---|---|---|
| | | tons | cwts. |
| Summer crop (February-March) . . . . . | 928 | 27 | — |
| Winter » (June-October). . . . . | 196 | 6 | 1 |
| Total yield . . . | 1124 | 33 | 1 |

In addition to these 1124 cases exported to Brisbane about a score were sold or consumed locally.

A plantation of " Smooth pine " of one acre gave in the 18th month 225 cases as a summer crop and 182 cases later, as a winter crop.

The prices of pineapples at Brisbane in October were: Queens 8 to 12/- per case ; " Ripleys " 9/- to 11/- per case ; " Common " 8/- to 10/- per case. The retail prices were " Ripleys " 8/- to 9/- per dozen: " Rough " 3/- to 6/- per dozen ; " Smooth " 3/- 6/6 per dozen.

These yields, checked by the Superintendent of Fruit Culture of the Queensland Department of Agriculture are the result of careful cultivation and rational manuring, and are therefore not to be considered as exceptional.

305 - **A Suggested Explanation of the abnormally High Records of Doubles Quoted by Growers of Stocks (*Matthiola*).** — SAUNDERS EDITH R. (Lecturer Newnham College, Cambridge) in *Journal of Genetics*, Vol. 5, No. 2, pp. 137-143. Cambridge, Dec. 1915.

During recent years the writer has obtained considerable evidence to show that the actual output of doubles among the strains of stocks now in cultivation does not exceed 56 to 57 per cent. Florists lists, however, still advertise strains capable of yielding 80 per cent of doubles.

Additional evidence is produced to show that the greater viability of the double producing seeds, as compared with the single, will account for the increased output of doubles.

A certain gardener isolated a strain of white stocks which gave the following results in his flower beds during 4 years :

| | Singles | Doubles |
|---|---|---|
| 1911 . . . . . | 28 | 194 |
| 1912 . . . . . | 17 | 93 |
| 1913 . . . . . | 30 | 180 |
| 1914 . . . . . | 55 | 216 |

A control experiment was carried out with seed of this strain collected in 1911. Every seedling produced was grown until it flowered so as to avoid any sort of partial record. The result was 185 singles and 224 doubles or about 55 per cent., thus proving that this strain behaves exactly like all other strains when completely grown.

When the seedlings were classified according to their vigour the proportion of doubles varied from 75 per cent. in the most vigorous group to 40 per cent. in the least vigorous groups.

306 – **The Effect of Various Dressings on Pruning Wounds of Fruit Trees.** — Howe, G. H. in *New York Agricultural Experiment Station, Bulletin*, N° 396, pp. 83-94. Geneva N. Y., February 1915. . FRUIT GROWING

An account of experiments, begun in 1911, with different substances on pruning wounds of fruit trees, in order to determine the effect of the various compounds in accelerating the cure of the injury and their preservative action against the attacks of fungi and injurious insects. These experiments have been made on apple trees (as representative of the pome fruits) and on peaches (as representative of stone fruits). The following substances were employed : white lead, white zinc (both mixed with linseed oil), yellow ochre, coal tar, shellac and Avenarius carbolineum. They were applied, at different times of the year, to pruning wounds of various sizes, some newly inflicted and others of some weeks' standing. The effects were observed, both in the case of the treated wounds and in that of those which were left open, at the end of the first and the second season of growth. The principal results were as follows :

In all cases the untreated wounds healed more rapidly than those protected by any of the substances enumerated. Amongst the latter, shellac seemed, during the first period of growth, to excercise a stimulating effect on the development of bark around the wound ; this effect, however ceased at the second period of growth. Shellac caused the least injury to the tissues of the cambium, but, on the other hand, it had the least adhesive power. Avenarius carbolineum and yellow ochre did so much harm to the cambium that, in the writer's opinion, they should never be used for covering pruning injuries. The lesion produced by coal tar was less serious, but this substance disappeared more quickly owing to absorption and evaporation. — White lead and white zinc also produce a slight injury to the cambium tissues when they are first applied, but these tissues soon recover, and at the end of the first growth period hardly any trace of injury is left. White lead and white zinc were the most efficacious of all the compounds used, and the former was the better of the two.

Nothing is gained by waiting some weeks after pruning before applying the dressings.

All the substances used in the experiments in treating the pruning injuries of peach trees produced such damage to the wood, that the wounds did not close. Consequently these substances should never be applied to the wounds of the peach ; this probably applies to all other trees with stone fruit.

In no case were the wounds, whether open or protected, observed to be invaded by fungi. As the substances used seemed rather to retard the healing of the wounds, it may be concluded that the treatment of injuries to the wood is, to say the least, useless. Nevertheless, had the experiments been carried further, it is possible that they might have exercised a useful effect upon the healing of very large injuries ; this however still remains to be proved.

307 – **Soils of Massachusetts and Connecticut, with Especial Reference to Apples and Peaches.** — WILDER HENRY J. (Scientist in Soil Survey) in *U. S. Department of Agriculture*, Bulletin No 140, pp. 73, plates 21. Washington, April 1915.

This is a study, for Massachusetts and Connecticut, of the soils, climate, general conditions of orcharding and its future, methods of fruit growing, connection between the character of the soil and its suitableness to the different varieties of peaches and apples. This latter part is summarized by the writer as follows :

Under cultivation, mellow loans and fine sandy loams overlying medium clay loams of friable structure excel for the Baldwin. Under the same soil conditions Rome Beauty thrives further south, where the climate is a little warmer. Heavy silty loam or light silty clay loam with similar subsoil brings a good "green" Rhode Island Greening, but lighter soils, such as fine sandy loams and warm mellow loams, excel if a high flush is desired.

Soils favouring the Hubbardson are rich fine sandy loams, or heavy loamy fine sands with subsoils of fine sandy loam or mellow loam.

For the Northern Spy and the Wagener, a mellow medium loam underlain by heavy loam or friable light clay loam is desirable, but the supply of humus and the application of ammonia carrying fertilizers should be much greater for the Wagener than for the Northern Spy.

The heavier of the soils described for the Baldwin seem promising for the Mc Intosh.

For Tompkins King and Gravenstein, an open textured loam, rather than a fine loam, with a subsoil of the same or only slightly heavier texture, is preferred. While similar soils are excellent for Ben Davis and Gano, it is believed that these varieties should be grown outside of New England.

Both the Tompkins King and the Northern Spy soils give good results with the Fall Pippin.

A deep rich loamy soil with subsoil of at least medium porosity, preferably a sandy loam, is excellent for Roxbury.

Soil adaptedness under Connecticut conditions, to some of the commercial varieties of peaches, is as follows :

Champion succeeds best on soils of only medium productivity but they should be deep and well drained. Medium to heavy friable sandy loams underlain by material not heavier than a friable loam and preferably a heavy sandy loam, are very desirable.

Carman and Mountain Rose succeed best on soils somewhat less porous than the Champion but still deep and well drained. This soil condition seems typically supplied by the loams of the Wethersfield and the Middlefield series.

The Elberta and the Belle prefer stronger soils than the Carman and the Mountain Rose. Loams, silty loams and silt loams, with subsoils o similar material, seem best to meet these requirements under Connecticu conditions.

For Late Crawford, a fairly strong soil, such as a light porous loan somewhat less retentive of moisture than the heaviest of the Elberta soil is desirable.

Some of the early varieties, such as Greensboro, are less sensitive to shallow soil conditions than the varieties mentioned above.

308 - **Report on New or Noteworthy Fruits by the New York Agricultural Experiment Station, Geneva, N. Y. United States.** — HEDRICK, U. P. in *New York Agricultural Experiment Station Bulletin*, N. 403; pp. 211-220. Geneva N. Y., April 1915.

This is the third report on new or noteworthy fruits from the New York Agricultural Experiment Station. The Station aim is that of testing all varieties offered on the market and recommended by the New York State nurserymen. The following numbers of varieties were being grown in 1914: Apples, 412; pears 276; quinces, 18; peaches, 394; nectarines, 34; apricots, 47; plums, 296; cherries, 99; grapes, 404; currants, 33; raspberries, 70; blackberries, 41; gooseberries, 63; strawberries, 114; total number of named varieties, 2301.

Before describing the new varieties, the writer has found it necessary to make an introductory statement on the relative value of new and standard varieties for commercial planting, as the varieties described in the first two bulletins on new fruits have evidently not been viewed in the right perspective by some of the readers.

The tendency on the part of many commercial fruit growers is to plant at once on a large scale the sorts recommended as promising in this series of bulletins, without bearing in mind that, no matter what the merit of a new fruit may be, it is often difficult to market it advantageously. A new variety must be looked upon as a speculation or as an experiment. A commercial fruit grower should let new varieties stand the test of time, demonstrate their value — in other words, become " standard " — before planting them extensively. — Standard varieties, for which the demand is much higher, should therefore form the basis of every good commercial plantation, although a few plants of a few new varieties may also be grown for trial.

*Peach.* — *Niagara* is a variant of the *Crawford* peach. This group, though a dominant type, is a little too capricious as to soil and climate to suit the needs of commercial fruit growers, failing to bear regularly or abundantly in any but particularly good peach soils.

The best of the group is the *Niagara*. It ripens early in September, the fruit is yellow, with a handsome overcolour of red. The flesh is yellow, thick and firm, with a rich sweet flavour which makes it one of the most palatable peaches of its season. It is, as most of its type, a freestone. Its great point of merit, as compared with other Crawfords, is that it is less capricious as to soil and climate.

*Grape.* — *Muscat Hamburg* is known in America and especially in the eastern States as a hot-house variety, the best adapted for forcing, but has lately shown itself to be also the best *Vitis vinifera* for out-door cultivation. In New York State when grafted on roots resistant to phylloxera, it requires only some protection during the winter by covering lightly with earth. It will grow and bear regularly alongside of Concord, Niagara or Delaware.

*Cherry.* — *Lambert* originated in Oregon and is now a standard variety

in its native State but is still on probation in eastern America. It is a Bigarreau, a seedling of Napoleon by Black Heart. The tree, for its strength vigour and health, and the fruit, for its beautiful purple colour and firm and juicy flesh, are both valued very highly. It is well worth testing for either home or market, and should find congenial soil and climate in many parts of New York State.

*Plum.* — The *Late Muscatelle* plum has been tested for ten years at the Geneva Station and has come to be regarded as one of the best late plums out of the 500 or more that have been fruited with it. The plums are rotund in shape and of a beautiful purple-brown colour slightly mottled with russet. The flesh is tender, meaty, firm, juicy, sweet and aromatic. As a culinary fruit it can hardly be surpassed. For home use and local market trade it is certain to prove a valuable variety.

*Gooseberry.* — *Industry* is the most popular of all English kinds in America. The bushes are strong, stocky, vigorous growers and most productive. The greatest fault with this, as with all English varieties, is the tendency to mildew. The berries are of large size, roundish oblong, ranking high in quality. Good for preserving and canning. It is worth being more generally planted.

309 - **The "Aribaud" Peach; A New Variety from France.** — Desmoulin Am., in *Le Progrès agricole et viticole*, Year 37, N° 2, pp. 44-45. Villefranche (Rhône), January 9, 1916.

The "Aribaud" variety of peach (obtained by Dr. Aribaud at Condrieu, Rhône, France) has, for some years, been much cultivated in the part of the Rhône valley lying between Vienna and Saint-Rambert-d'Albon. Owing to its vigour, its foliage and fructification, as well as the shape of its fruit, this peach should be undoubtedly classified among the American varieties and comes probably from a plantation of "Precoce de Hale" of which the trees were used as grafting-stocks.

The "Aribaud" peach tree is very vigorous and prolific; its fruits are very large, weighing on an average from 5 ¼ to 7 ozs. (some peaches weighed as much as 10 ½ ozs.); they are well-shaped, round and very firm and therefore travel well. The kernel is quite detached from the pulp. The colour of the fruit is fine, although of a duller red than in other varieties, the pulp is white, of excellent quality and very juicy. In the above-mentioned region, the peaches ripen, on an average, between the 5th and 15th of August. The "Aribaud" peach tree is somewhat exacting as to soil, which must be rather deep and fertile; it cannot resist drought, which causes the fruit to fall. It is best planted 13 × 13 ft. apart or at 13 × 16 ft.

The writer recommends the cultivation of this peach, especially in commercial orchards, for purposes of export.

310 – **Observations Upon Direct Bearers in the Vaudois Vineyards (Switzerland).** — FAES H. (Head of the Physiological Section), and PORCHET F. (Head of the Chemical Section of the Vine-Growing Station at Lausanne). — I. *Observations sur les Producteurs directs dans le vignoble vaudois*, 1915; Lausanne, Imprimerie Vaudoise. — II. *Le Progrès agricole et viticole*, Year 32, Nos. 33-35; 37-39; pp. 155-161; 210-212, 254-260; 301-305. Montpellier. August 15 — September 26, 1915.

A summary of a large amount of evidence collected since 1906, with the assistance of the Staff of the Lausanne Viticultural Station.

Researches made of late years have often led to the conclusion that direct bearers are adapted:

1) Especially to regions where mixed crops are grown, and where the hay-making and harvest operations are often accompanied by the application of sulphates and sulphur mixtures.

2) To vineyards where the damp climate does not permit very frequent sprayings with sulphur.

Since many of the Swiss vineyards are situated under such conditions it would appear *a priori* that they could be planted with direct bearers. This is, however, not the case, for in the Swiss, and more particularly the Romand vineyards, the substitution of hybrid direct bearers for native vines can only be effected satisfactorily under the following conditions:

1) The direct bcares must above all be resistant to fungoid diseases and, if possible, to phylloxera.

2) In the case of a Romand vineyard the direct bearer must, in addition, supply grapes and wine similar in character and qualities to the produce of the vines it is to replace; these are practically reduced to two the «chasselas» and «petit pinot» varieties.

This is asking a good deal, but these requirements are justified. In a normal year, the Swiss vineyards produce a *little less than half* the wine consumed in the country; the native products, which are greatly exposed to foreign competition (for foreign wines under the present Customs regulations can be bought cheaper than Swiss) can only hold their own thanks to their special characters, which justify the marked preference shown to them by the native consumer. In order to insure their further existence therefore, the Swiss vineyards must first of all maintain the special characters of their products which enable them to compete successfully with foreign wines on the market, even when these are sold at lower prices

The Viticultural Station at Lausanne being particularly anxious to prevent any injury to the quality of the native wines by the haphazard introduction of direct bearers into the Vaudois vineyards, has made practical investigation of the principal characters shown, under the climatic and soil conditions of the Canton de Vaud, by a certain number of hybrid direct bearers. These were kept under direct observation in the Experimental vineyards of the Station. These vineyards, which are 8 in number, and differ greatly in soil and exposure, have each an area of about 32300 sq. yds and are divided into 3 plots planted as follows:

Plot I. — "Chasselas fendant" grafted on the series of different stocks.

Plot II. — The direct stocks bearers of most interest to the region.

Plot III. — Native ungrafted vines serving as controls.

The results obtained may be summarised as follows:

Resistance to Mildew. — This in most direct bearers is superior to the resistance shown by *Vitis vinifera*. It varies enormously from one number to another and from one year to another. It is very pronounced in old direct bearers such as Noah, Duchess and Huntingdon; remarkable in the series Riparia × Gamay Nos. 595, 604, 605, 701 of Oberlin; considerable in Seibel Nos. 1,712, 2003, 2007, 2063, 4444; Couderc 146-51; Castel 1028. Unfortunately, this quality, possessed by hybrid direct producers, of resistance to mildew is often balanced by serious defects: grapes with wrong flavour, (Noah, Duchess, Huntingdon, Seibel 712 and 4444, Castel 1028), or too acid (Seibel 2003, 2007; Couderc 146-51) or too small (Oberlin 595, 604, 605, 701). Seibel 2007 has the well-known defect of not maturing its wood anything like sufficiently.

Resistance to Oidium. — Under unfavourable conditions, the following stocks are very susceptible to Oidium: Seibel 713, 880, 1020, 2735, 2791, 3858; Couderc 74-17, 82-12, 89-82, 106-46, 117-3, 198-89, 199-88, 272-60, 343-14, 4401: Malègue 148-4, 292-1, 314-15; Castel 14539 and 19002 Bertille Seyve 139 and 413; Oiseau rouge. As a rule, oidium seems to be a formidable enemy of a large number of hybrid direct bearers; some of the latter lose their leaves on coming into contact with the smallest amount of sulphur.

Grapes with imperfect flavour. — These are very numerous. The following vines especially have this defect:

Seibel 21, 62, 69, 78, 117, 254, 621, 645, 712, 793, 802, 803, 840, 861 1060, 2676, 2822, 2879, 2881, 2892, 4132, 4145, 4444; the Coudercs 241-125 and 343-14; the Castels 1028, 1113, 19002; Bertille Seyve 136, 184, 227; Gaillard 2; Noah, Plant des larmes, Viennois, Plant Fournier, Bacchus, Huntingdon, Hybride franc, Delaware. In some years the foxy or scented flavour of these grapes is much more marked than other years and it depends on the degree of maturity attained by the fruit.

### Direct Hybrid Bearers Regarded as Unsatisfactory for Various Reasons.

*Taste too insipid:* Seibel 42, 130, 131, 215, 242, 426, 778, 2033, 2696, 4436, 7501; Couderc 267-27; Bertille-Seyve 138.

*Extreme acidity, or lack of sugar:* Seibel 2, 138, 175, 404, 724, 873, 2785, 3858; Couderc 81-22, 90-38, 136-4, 146-51, 198-21; Castel 6518, 13519; Bertille-Seyve 236; Oberlin 701; Jurie 580; Oiseau bleu; Oiseau rouge.

*Mixed pink and green grapes:* Seibel 1, 450, 452, 716, 835, 2620, 3704; Couderc 28-112; 71-61, 106-51, 4401; Jouffreau; Plant des Pardes; Alicante × Terras.

*Grapes too small, or bunches too loose:* Seibel 477, 2573, 2613, 2738, 2779; Oberlin 595, the wine of which is much to be recommended in several respects; it is of a fine colour, and has a pleasant fruity flavour.

DIRECT BEARERS CONSIDERED AS OF INTEREST WITH REGARD TO THE SPECIAL CONDITIONS OBTAINING IN THE VAUDOIS VINEYARDS.

After the removal of the unsatisfactory bearers, there remain out of the 159 direct bearers that had been kept under observation only 14 (8 black and 6 white) which give hopes of more promising results. These are the following : *Black :* Seibel 156, 782, 2003, 2006, 2007, 2063 ; Couderc 7104, Oberlin 604. — *White :* Seibel 880, Couderc 88-51, 117-3, Castel 1028, Gaillard 157, Duchess.

They show the following characters :

*Seibel* 156. — Fairly good resistance to fungoid diseases ; production satisfactory ; sugar (in different vineyards and seasons) from 11.3 to 23.3% ; total acidity from 7.0 to 25.0 gms. per litre. Wine coloured, brilliant, clean taste, with 9.2 % of alcohol ; 8.7 gms. of total acidity, and 30.1 gms. of total extract per litre (after 1 year in bottle).

*Seibel* 782. — Good resistance to fungi, very productive, somewhat acid. Sugar (average of 2 years) 12.05 % ; total acidity 16.05 per litre. Wine a little too acid some years.

*Seibel* 2003. — Resists disease well, good yield ; large grapes, rather tart. Sugar 9.3 to 15.6 % ; acidity : 12-18.5 gms. per litre (3 different years). Wine sometimes well balanced ; occasionally too acid and watery.

*Seibel* 2006. — Fairly resistant to fungi ; large grapes ; vinous, but a little tart. Sugar (in different seasons and places) varies from 8.6 to 22.9 % ; total acidity 7.8-22.6 gms. per litre. Wine light, usually well balanced and pleasant.

*Seibel* 2007. — Large grapes ; heavy yield ; ripens its wood very badly ; resists fungoid disease well ; sugar 10 to 19.7 % ; acidity : 7.8 to 25.3 gms. per litre. Vines light, sometimes with pleasant taste, some years extremely watery and acid.

*Seibel* 2063. — Large grapes ; moderate yield, good resistance to fungoid disease ; sugar 12 to 18.4 % ; total acidity : 9.9 to 15.3 gms. per litre.

*Couderc* 7104. — Fairly acid ; large grapes ; a little attacked by Oidium ; sugar 11.8 to 18.9 % ; total acidity 9 to 20.3 gms. per litre.

*Oberlin* 604 — Sweet and highly coloured, but with very small grapes and poor yield. Good resistance to fungoid disease, sugar : 20.6 to 33 % ; total acidity ; 6.7 to 15.8 gms. per litre. Good wine ; alcohol : 11.8 to 13.6 % ; (in 1911, 1912 and 1913) ; total extract : 22.6 to 34.4 gms. per litre ; total acidity : 6.2 to 8.3 gms. per litre.

*Seibel* 880. — Fairly resistant to fungoid disease ; sweet, pleasant. Sugar 14.9 to 17.2 % ; total acidity : 7.6 to 11.6 gms. per litre.

*Couderc* 88-51. — Resists fungi well. Good yield. White, rose-coloured, clean taste, grapes small. Sugar : 14.9 to 18.8 % ; total acidity 7.3 to 18.8 gms. per litre. Wine fairly good.

*Couderc* 117-3. — Rosy white. Slight caramel taste ; pulpy, but sweet ; grapes small ; yield rather small. Resists mildew well, but is much attacked by Oidium. Sugar : 13.8 to 25 % ; acidity : 3.9 % to 17.1 gms. per litre.

Fairly good wine, rich in alcohol and extract, of normal acidity, slight caramel flavour.

*Castel* 1028. — Sweet, large grapes, slight foxy-musk taste, good resistance to fungoid diseases. Sugar 15.1 to 19.9 % ; total acidity : 5.7 to 12.4 gms. per litre, normal wine : the 1911 vintage contained : alcohol 12 % ; extract 17.8 gms. per litre ; ash : 1.34 gms. ; total acidity : 5.2 gms.

*Gaillard* 157. — Rosy in warm years, plentiful yield ; moderate-sized grapes. Sweet, somewhat flat flavour recalling the grapes of the Chasselas variety. While distinctly more resistant than the native vines, it suffers from mildew and oidium, as well as from *Cochylis*. Sugar : 11.5 to 21.8 % ; total acidity : 5.4 to 17.6 gms. per litre. This is the direct bearer which, under the conditions of the experiments, most nearly resembles the Chasselas variety and its grapes might be mistaken for those of the native vine. Wines of clean taste much resembling those made from Chasselas grapes ; in favourable years nearly identical, in bad seasons inferior.

*Duchess*. — Sweet, flat, average yield ; good resistance to disease.

The following conclusions are drawn :

None of the direct bearers that were the subjects of the experiments possess all the necessary qualities enabling them to be recommended to the wine-growers of Romand Switzerland as substitutes for the wines on which their present reputation is based.

However, the real progress made in this direction allows us to hope that the steady researches of those engaged in hybridisation experiments may one day provide the Vaudois vineyards with a sufficient number of vines which satisfy the requirements of the special conditions obtaining. It is therefore not rash to admit that the results hitherto obtained by the Lausanne Viticultural Station in its experimental vineyards are an encouragement to continue the study of the best numbers of hybrid direct bearers.

311 – **Testing Grape Varieties in the Vinifera Regions of the United States.** — Husmann, George C. (Pomologist in Charge of Viticultural Investigations) *U. S. Department of Agriculture Bulletin* No. 209, 157 pp, 10 tables, Washington, August 6, 1915.

A resumé of the viticultural investigations in the Vinifera regions of the United States up to 1910 was reported in *Bulletin* 172 *of the Bureau of Plant Industry*. This *Bulletin* No. 209 supplements that work and gives additional data on the following subjects :

1. — A comprehensive test of the resistant varieties of vines to determine their adaptability to the different soils and climatic conditions.

2. — A study of the congeniality of Vinifera varieties to the different resistant-stock varieties.

3. — A study of the behaviour of fruiting varieties to determine those best suited to the different localities.

4. — A consideration of all classes of grapes with reference to their resistance to destructive insects and diseases and, if found necessary, the origination of an entirely new class of grapes better adapted to Pacific coast conditions.

To afford facilities for solving these problems, the Bureau of Plant Industry has established 12 experiment vineyards in various parts of Cali-

fornia. The total average of these vineyards amounts to 51.3 acres. The writer gives tables setting forth :

1. — The average of each vineyard and the number of resistant vines, direct producers, viniferas on their own roots and viniferas on resistant stocks planted in each.

2. — The temperature and rainfall at the twelve experiment vineyards.

3. — The cultural data of fourteen American species of grapes whose varieties or hybrids are under test as resistant stocks in the said vineyards.

4. — The growth rating of resistant and direct producing varieties in eleven of the vineyards.

5. — The best growth records and relative merits of resistant-stock varieties in each of eleven of the vineyards.

6. — Varieties of American native and France American grapes under test on their own roots in eleven of the vineyards.

7. — Relative behaviour and value for different purposes of grape varieties tested by grafting on resistant stocks and by growing on their own roots.

8. — Relative behaviour and value for different purposes of improved native American and Franco-American varieties growing on their own roots.

From the abundant material thus collected and elaborated, the following are some of the conclusions drawn :

Different species used as stocks with the same variety grafted on them may increase or diminish its vigour and productiveness ; increase or diminish the quality, size and appearance of the fruit ; cause it to ripen earlier or later, and bring about results varying from perfect success to almost complete failure.

Extensive saccharine and acid determinations made of varieties grafted on resistant stocks and contrasted with the congeniality and growth ratings made of the same vines the same season, show a close correspondence between these important chemical constituents of the fruit and the congeniality of graft and stock. Similar growth ratings of a variety grafted on various stocks are found to be accompanied by fairly definite percentages of sugar and acid. The congeniality of the variety to the stock materially affects the resistant qualities of the stock.

The quantity and quality of the fruit are usually in opposition on the soils and vines producing most abundantly ; the fruit is usually not of so much value per given unit as it is on vines that are relatively less productive.

Most vine varieties making perfect growth on resistant stocks are found to yield heavier crops than the same variety when grown on its own roots.

Cuttings of many hybrids root easily, although the cuttings from one of the parents may be hard to root.

Where conditions are not suited to a given species, they are often well adapted to hybrids of that species with some other species.

As cuttings of Monticola, Berlandieri, Aestivalis, Lincecumii, Bicolor and Caudicans are hard to root, they should be rooted in the nursery and grafted there, or planted in the vineyard and grafted afterwards.

Riparia cuttings root easily and are excellent stocks well suited for vineyard and bench grafting, but they are adapted to but few California soils. Soils in which Riparia varieties thrive usually produce large crops of only fair quality.

Rupestris cuttings root and graft easily and are best adapted to bench grafting. When so used the dormant eyes should be cut out of the stock. Many varieties are not congenial to Rupestris, and their fruit is usually somewhat later in ripening than when grown on some other stock.

In most instances Riparia, Berlandieri, Champini, and Aestivalis stocks are congenial to Vinifera varieties. Their fruitfulness is increased and the time of ripening hastened in comparison with the same varieties grown on other stocks.

Some of the hybrid resistant stock varieties are making enviable records as stocks under California conditions.

## LIVE STOCK AND BREEDING.

HYGIENE

312 – **Experiments in Vaccination against Anthrax** — EICHHORN, ADOLF (Chief of the Pathological Division) in *U. S. Department of Agriculture, Bulletin* No 340, 16 pp. Washington December 1915.

The writer describes the production of anti-anthrax serum and the methods followed for determining its potency. He notes the disadvantages of vaccination by the PASTEUR method, among which the unstable keeping quality of the Pasteur vaccine. In experiments conducted by the Bureau of Animal Industry of the U. S. Department of Agriculture it was found that in some instances a vaccine remained potent for a year, in others it proved inert within three months of its preparation.

The writer carried out the following experiment :

On September 8, 1914, two horses were vaccinated against anthrax according to Pasteur's method. On September 29 their hyper-immunization began by giving them approximately 0.01 of a loopful of virulent anthrax bacilli subscutaneously and was continued as follows :

| Date | Amount of virus given each horse |
|---|---|
| Oct. 21 | 1 loopful |
| Nov. 15 | 10 loopfuls |
| Dec. 9 | 5 cc. of an emulsion representing one-half growth of agar culture |
| Dec. 29 | 20 cc. of emulsion representing washing of growth from 2 agar cultures |
| Jan. 19 | 30 cc. emulsion, growth from 8 agar cultures. |
| Feb. 6 | 40 cc. emulsion, growth from 2 mass cultures from flasks, surface area $6 \times 2\,^1/_4$ inches |
| Mar. 7 | 50 cc as above from 4 mass cultures |
| Mar. 31 | 50 cc. as above from 8 mass cultures. |
| April 19 | do. |
| April 28 | do. |
| May 11 | do. |
| May 21 | do. |
| June 12 | do. |

In the above work four strains of anthrax bacilli were used, known as "Davis", "0071", "Burt", and "Boener", the first two being highly virulent types and the latter two very much weaker.

On June 25, 1915, 6 litres of blood were drawn from each horse. Since then these animals have been bled regularly, 6 litres being taken from each horse, and an injection of virus made in the intervals between bleedings.

In standardizing the serum, that taken from each horse was tested separately on guinea pigs into which 48 hours later a bouillon subculture of an attenuated strain known as "Davis D" was injected. The results of the serum of the two horses agreed, 5 guinea pigs out of 6 remaining alive while with the normal horse serum 5 out of 6 died.

In view of these results the "Davis D" culture was used in the preparation of the spore vaccine to be used simultaneously with the serum.

For the preparation of the spore vaccine the writer recommends using peptone-free agar media and, after inoculation with the attenuated culture, growing the organism at a temperature of 37.5° C. for 4 to 7 days, by which time an abundance of spores will have formed. The growth is then collected in a sterile flask and heated at a temperature of 60° C. foi half an hour to destroy the vegetative forms of the organism. A measured quantity of this suspension can then be plated out in the usual manner and the spore content of 1 cc. of the suspension established. A dilution can then be made to the desired amount for inoculation purposes. For cattle and horses 1 cc. of vaccine containing 1 000 000 spores would constitute a proper dose, while for calves and sheep it has to be correspondingly smaller.

The pathogenicity of spore vaccine should be such that an inoculation of approximately 250 000 spores (0.25 cc. of the standard suspension) kills guinea pigs in from 2 to 5 days while rabbits remain alive.

For immunization purposes by the simultaneous method the serum should be injected first, then the spore vaccine.

In herds where the disease has already made its appearance it is necessary to take the temperatures of all the animals and to subject to the simultaneous vacination only those that show no rise in temperature. All others should be given the serum-alone treatment in doses varying in accordance with the severity of the symptoms. If there is a considerable number of infections, it is advisable to use the serum-alone for all the animals, and in 3 or 4 weeks to revaccinate by the simultaneous method.

The simultaneous method was experimented on cattle and sheep at the experiment station of the Bureau of Animal Industry at Bethseda, Md. with success.

The serum treatment was tested on pigs in a Maryland farm with the result that every affected animal recovered and not a single death from authrax occurred among those animals that received protective doses of the serum.

The serum and spore vaccine treatment was applied on several farms in Queen Anne County Md. to a total of 399 animals, including horses, mules, cattle, sheep and pigs, and to a total of 125 cattle in Noxubee County Miss. in both of which places the disease had broken out. No deaths

from anthrax occurred after the vaccination, the affected animals all recovered from the disease.

For the use of serum in the treatment of anthrax in man it is recommended that from 30 to 40 cc. of serum be injected in three or four different places.

*Conclusions :*

1) Horses are suitable for the production of highly potent anthrax serum. Serum of such horses should protect large animals in 10 cc. doses.

2) The use of the serum-alone treatment is indicated in cases where the infection has already occurred in a herd. Since the serum confers only a passive immunity, it is advisable to revaccinate the herd in from 3 to 5 weeks by the simultaneous method.

3) The serum possesses great curative value. Depending on the severity of the infection, the curative dose is from 30 to 100 cc., the injection to be repeated if necessary.

4) For the simultaneous treatment a spore vaccine, carefully standardized, is preferable to the ordinary Pasteur vaccine.

5) Spore vaccine should be employed also in preference to the Pasteur vaccines for immunization with vaccine alone. This vaccine has a decided advantage over the Pasteur, because of the possibility of more accurate dosing and because of its better keeping qualities.

6) Experiments with concentrated serum and dry spore vaccine are very promising. This method would greatly simplify the vaccination process and also insure the product against subsequent contamination and deterioration.

313 - **Studies on Changes in the Degree of Oxidation of Arsenic in Arsenical Dipping Baths** (1). — CHAPIN, ROBERT M. in *Bulletin of the U. S. Department of Agriculture*, No. 259, 12 pp. Washington, July 1915.

For some years past it has been known that in the arsenic dips which are extensively employed for eradicating cattle ticks, the sodium arsenite gradually oxidizes to sodium arsenate, which is less poisonous and less efficient against ticks. FULLER of the Bureau of Animal Industry showed that this change is essentially brought about by the growth of micro-organisms in the dipping baths, other factors being relatively of little importance. Studies on this subject have been continued during the part two years.

The field experiments of 1913 involved the taking at fortninghtly intervals of samples from a number of vats in different sections of the country, and of testing them at the vat, after which they were sealed with wax or paraffin and analyzed at the laboratory. The results were plotted in diagrams.

The laboratory experiments consisted :

1. — In inoculating a mixture of peptonized broth with stock arsenic solutions (arsenite and arsenate) with a portion of used dipping bath from the field. The mixtures were then left at room temperature for var-

(1) See also *B.* June 1913, No. 691 (*Ed.*)

ying lengths of time, after which they were again analyzed and their final composition compared with their initial one.

2. — In testing the efficacy of some antiseptics against the activity of the reducing and oxidizing organisms.

The experiments of 1914 were directed toward determining the efficacy and practical applicability of formaldehyde as a preservative against oxidation of dipping baths in the vat.

From the results obtained the following conclusions may be drawn:

1. — All used arsenical dipping baths may be expected to contain: *a*) oxidizing organisms which work slowly, but steadily and persistently and *b*) reducing organisms which work very rapidly at times, but spasmodically. The reducing organisms exert an appreciable effect only n vats which are used at frequent intervals for dipping large numbers of cattle. The ordinary vat, used once a fortight, is likely to show only slow, steadily progressing oxidation of the arsenic, and periodical analyses must be made if proper dipping strength is to be maintained.

2. — Formaldehyde solution (37 per cent) used in the proportion of gallon to every 1500 gallons (8 ½ fluid ounces to 100 gallons) of liquid ntroduced into the vat, appears a safe and effective means for reducing oxiation to a low figure. But since there seems to be no evidence that under rdinary conditions oxidation is ever likely to progress so far as to result the use of baths injurious to cattle, the question of the use of formalehyde is purely economic. The writer believes that in most cases it will e cheaper to let some of the arsenic go to waste through oxidation. When he cost of a gallon of formaldehyde about equals the cost of all the materials ecessary to make 500 gallons of dipping bath, there will probably be little nancial gain either way, while there may be some real profit in its use hrough saving of labour in preparing the dip and through the reduction offensive odour from the bath by keeping it under antiseptic conditions.

4 - **The Precipitin-Reaction of Pork Infested with *Cysticercus cellulosae*.** — Sparapani, G. C. in *La Clinica Veterinaria*, Year XXXIII, N° 21, pp. 845-850. Milan, November 15, 1915.

During the winter 1914-1915 all the specimens of measly-pork from the unicipal abattoirs of Venice were examined by means of the precipitin action to determine if all the diseased pork gives the reaction and whether is reaction is strictly specific for the parasite.

After giving a minute description of the specimens examined and of e procedure followed the writer makes the following conclusions:

1) By means of the precipitin-reaction parasitic antibodies can be nd in the serum of measly pork.

2) These antibodies, however, do not appear to be absolutely specific, in 5 cases positive results were obtained in treating an albuminous solun of measly pork with the antigen of *Cysticercus cellulosae* and also with e antigen of *Echinococcus*. In other cases positive results were obtained treating an albuminous solution of pork infested with *Echinococcus* with e antigen of the cysts of *Echinococcus* and of *Cysticercus cellulosae*.

3) These antibodies were also obtained from 3 cases of meat containing degenerated *Cysticercus cellulosae*.

4) In two cases of parasitic infections not caused by Cestodes these antibodies were not found.

315 – **The Problem of Horse Sickness in South Africa.** — THEILER, SIR ARNOLD in *The South African Journal of Science*, Vol. XII, No. 3, pp. 65-82. Cape Town, October 1915.

The agent responsible for the malady (common in South Africa) known as horse sickness is a micro-organism which, belonging to the group of the ultra visibles, is generally spoken of as a virus. There are two forms of the disease, known respectively as the "Dunkop" and "Dikkop" forms. No positive proof has yet been obtained as to how the virus gains access into the body of a susceptible horse but all the evidence points to the agency of winged insects, particularly mosquitoes. Attempts to convey infection by means of these latter have, however, met with no result, notwithstanding the large number of species used. Possibly the difficulty of keeping the mosquitoes alive for a sufficiently long period is partly responsible for the failure recorded.

With the object of discovering the source whence the insect host obtains its infection a number of inoculation experiments were made with birds (27 species), various wild mammals, reptiles and Amphibia. In addition to these the blood of domesticated ruminants, born and kept on a horse sickness farm, was used, and even that of a few natives, but results were always negative. The geographical distribution of both the disease and certain animals would give a clue as to the direction in which further experiment should be undertaken. For instance, it is known that horse sickness does not occur in Western Africa from North of Angola as far as North East Africa, but is present right through Central and East Africa to the shores of the Red Sea.

From a practical point of view, the question of immunity is of great importance. Horses and mules may recover from either the Dikkop or Dunkop form of the disease but are not as a consequence necessarily immune from fresh attacks. A number of horses were injected with two forms of virus, the first, known as the "ordinary virus, being obtained from a horse attacked by the sickness and the second, known as the "Tzaneen" virus, from a case of reinfection in a mule considered to be immunised. From the experiments it results that although a horse may not react to a virus at one moment, yet when reinjected with the same virus at a later date, death may result. Further, with ordinary virus more horses die of Dunkop than of Dikkop. With the Tzaneen virus the reverse is the case. A certain number, however, entirely failed to react.

The majority of the horses that survived the injections were later tested for their immunity. Again a certain number of horses failed to react and it is estimated that the number of horses that will resist all injections of virus and be considered completely immune is 3 to 4 per cent.

Of the horses that reacted to the original injection (both forms) a fa better immunity was given by ordinary virus, and, as regards the two form of the malady, a horse that has recovered from the Dikkop form of the ill

ness has a better chance of resisting later infection than one which recovers from the Dunkop form.

*Methods of cure or prevention.*— The use of several of the more familiar parasitiotropic drugs, *e. g.* arsenophenylglycin, salvarsan, novoflavin and some anilin dyes, has been unsuccessful. Nor is the use of serum therapy of much value from a curative point of view. Eradication of the disease is impossible as neither the virus reservoir nor virus transmitting insect are yet known; there consequently remains the protection of individual equines. Stabled animals can be protected against the disease effectively provided the stable is insect proof, as, however, horses and mules must be used at any time and frequently during the night, a protection applied to the skin comes into consideration. The use of paraffin oil has been fairly successful. Antiseptics of the tar-derivation group have also been used, particularly as sprays, with varying results. Lately, encouraging results have been obtained by dipping horses and mules at regular intervals in a cattle dip to which was added 3 gallons of linseed oil and 2 gallons of paraffin oil for every 300 horses. Experiments to obtain a better protective substance to be applied to the skin of horses are in progress.

316 – **Bush Sickness, Work at the Mamaku Farm, New Zealand.** — BEAKES, C. J. and ASTON, F. I. C. in the *Journal of Agriculture*, Vol. XI, N° 5, pp. 377-383, 3 figs. Wellington, November 20, 1915.

The New Zealand Department of Agriculture founded at Mamaku an experimental farm for the study of the disease called " bush sickness " which attacks cattle and sheep, especially young animals, grazing in the district. The work done at the farm since 1912 proves that the pastures which cause bush sickness are situated on soils which contain iron principally in a form unavailable under natural conditions, and produce herbage lacking the necessary chemical constituents. These pastures can be much improved by an abundant use of phosphatic top-dressing. Phosphates have given the best results, of these a mixture of basic slag and superphosphate undoubtedly has increased the growth of clovers to a greater extent than the other phosphates. A trial is now being given to a basic phosphate and to ground rock phosphate.

The efficiency of syrup of phosphate of iron both in curative and preventive treatment has already been well proved, but its one drawback is that it has to be administered by hand daily over a period of some three or four weeks at a time.

Experiments were therefore begun with cattle licks. After several trials with other mixtures one was finally adopted containing perchloride of iron and salt cemented together with plaster of Paris and a little lime. The stock in time become very fond of the lick. The bricks must not be left exposed to the rain which would dissolve out the constituents.

Sufficient evidence is already available to prove that this lick is of great value in maintaining health, but it must not be assumed that it is in itself sufficient to enable cattle and sheep to be kept healthy. It is still evident that proper manurial treatment of the soil is a most valuable factor in combating bush sickness.

Notwithstanding the above means, considerable difficulty is encountered in rearing young animals and further experiments are being conducted at the farm in order to solve the problem.

317 – **Beriberi and Cottonseed Poisoning in Pigs.** — ROMMEL, GEORGE M. (Chief, Animal Husbandry Division, Bureau of Animal Industry) and VEDDER, EDWARD B. (Captain, Medical Corps, United States Army) in *Journal of Agricultural Research.* Vol. V, No. 11, pp. 489-493. Washington, D. C., December 13, 1915.

Cattle fed for more than 90 to 102 days on a heavy cotton seed-meal ration (6 lbs or more per head daily) become lame and their eyes discharge freely, blindness often resulting. Pigs, also, are peculiarly susceptible to the effects of cottonseed meal, the symptoms of sickness appearing at any time after 3 weeks of feeding, and deaths frequently occur with little warning. The disease in these latter animals manifest two forms, acute and chronic, and among the more pronounced symptoms are diarrhoea; a harsh, rough, curly coat; paralysis, and shortness of breath. The conditions revealed on post-mortem examination bear a striking resemblance to those seen in the disease known as beriberi in man.

The writers have carried out a series of experiments to determine (*a*) whether the "wet" or acute form of beriberi could be produced in pigs on a diet of polished rice and (*b*) whether the disease hitherto called "cottonseed poisoning" is not really beriberi. The ration consisted of steamed polished rice and tankage (9 : 1) or of maize meal and cottonseed meal combined in varying proportions. In all cases the pigs developed the typical symptoms of beriberi.

The studies of the writers seem to lead to three general conclusions:

(1) Pigs are susceptible to beriberi when fed on vitamine deficient rations, such as rice. Symptoms of a pronounced character sometimes occurred after 8 to 10 days.

(2) It is believed that the so-called cottonseed poisoning of pigs is a deficiency disease, analagous to the disease known as beriberi in man, if not indeed identical with it. Acute cottonseed poisoning corresponds to wet beriberi, and the chronic form to dry beriberi.

(3) The cause of the so-called cottonseed poisoning is probably a deficiency in the ration, causing, among other manifestations, profound changes in the nervous system. The following explanation of this condition is offered: The grain with which the cottonseed meal is most frequently combined is maize. Maize is notoriously deficient as a single feed for animals, and must be properly balanced to be fed satisfactorily. When maize meal is fed with cottonseed meal, a combination is made of two feeds both of which are deficient.

The writers are engaged in further studies of this subject to determine more exactly the effects of cottonseed meal when fed in the ration of the pig, and to determine whether methods similar to those used to prevent beriberi in man can be practically applied to prevent the so-called cottonseed poisoning of pigs.

318 - **Observations on Fowl Cholera.** — MAZZUOLI, S. in *La Clinica veterinaria*, Year XXXVIII, N° 1, pp. 1-6. Milan, January 16, 1916.

Experiments at the Institute of Hygiene of the Veterinary School at Pisa show the serious nature and wide distribution of this disease. From a study of the means of and conditions necessary for the occurrence of this disease in practice the writer makes the following observations :

1) The ingestion of virulent blood and slime of fowls that have succumbed to the disease does not result in infection even if the quantity of virus ingested is considerable and even if the ingestion has been repeated several times.

2) Ingestion of faeces of sick fowls in any stage of the disease only in exceptional cases results in the infection of healthy birds.

3) The propagation of the disease is not effected by ectoparasites (*Argas persicus*).

The writer concludes that the diffusion of the disease is correlated with the presence in some part of the body, especially the feet, of wounds through which the virus from the faeces or slime gains entrance and readily infects the bird. In a similar manner infection may occur through lesions in the mucous membranes.

The results of these observations agree with those obtained by DOERS and PICK (*Centralblatt für Bakteriologie*, Vol. 76, p. 491, 1915) showing that the most frequent channel of infection is not the alimentary canal as is commonly supposed.

319 - **The Control of Contagious Epithelioma in Chickens by Vaccination.** — MACK WINFRED B. and RECORDS EDWARD, *Agricultural Experiment Station, The University of Nevada*, Bulletin N. 82, 16 pp. Carson City, Nevada, June 1915.

The etiological identity of roup, avian diphtheria, and contagious epithelioma is a subject of controversy which requires further extended research to settle. Consequently it is uncertain whether the cases dealt with in these experiments were caused by pure contagious epithelioma virus or were due to mixed infection.

The use of a virus prepared by triturating the morbid products collected from the skin and mucous surfaces and attenuated at 55° C. for one hour checked the spread of the disease promptly and exercised a favourable influence upon visibly infected birds. Cases thus treated ran a shorter and milder course than those not treated, and the mortality was materially reduced.

Two injections were sufficient in most instances, but severe advanced cases benefited by a third and larger dose.

In five flocks containing 3,062 birds, 1,668 of them thoroughly exposed and 1,394, or 45.52% of them visibly infected, the spread of the disease after vaccination was negligible. Of the 1,394 visibly infected birds treated, 299, or 21.45 % died, and 1,095 or 78.55 % recovered.

On the whole, the treatment was satisfactory and successful. In five flocks no unfavorable results followed the subcutaneous administration of the vaccine, but in two flocks serious toxic and septic processes were apparently caused by it. The crude preparation used is not, therefore, without

danger, and a more refined product must be devised. However, the conclusion appears warranted that in this method we have a fairly efficient means for promptly checking outbreaks of contagious epithelioma or the other uncertainly defined diseases, if there be more than one capable of producing similar morbid conditions in fowls, and a therapeutic agent of considerable value. Furthermore, that the prevention and control of this disease or group of diseases may eventually be placed on a sound scientific basis seems certain.

BREEDING

320 – **The Control of Sex.** — MOROSINI, A. in *Nuovi Annali di Agricoltura Siciliana*, Year IV, Series VI, Part III, pp. 162-169. Palermo, September 1915.

The writer summarises the most likely hypotheses advanced on the subject of the determination of sex.

1) *Hypotheses involving purely internal and organic factors:*

*a) Normal alternation of the sexes* (BERTHON, MESTURER, BOUCHUT, MASCARO).

*b) Maturation phase of the egg* (THURY, GIACCHI, GERBE, COSTE, ALBINI, DARTIGUES),

*c) Predominance of one parent over another* (GIRON, MARTEGOUTE, MANTEGAZZA, ORCHANSKY).

*d) Influence of the nervous system* (RAWSON, DORING).

2) *Hypotheses involving environmental or entirely external factors:*

*a) Influence of climate, seasons, temperature, etc.* (AXEL-KEY, DUSING, SIEBOLD, SACHS).

*b) Influence of nutrition* (JOUNG, NUSSBAUM, MAUPAS, CALKINS, MOLLIARD, LANDOIS, TREAT, KYBER, KNIGHT, BORNER, SCHENK, RUSSO, DUCCESCHI, TALLARICO, ROBINSON),

3) *Alternative hypotheses involving the influence of various factors* (CLEISZ, ORCHANSKY, RUSSO) (1).

4) *Hereditary hypotheses involving the existence of two special groups of Chromosomes following Mendels Law.* (CUÉNOT, BATESON, SAUNDERS, CASTLE).

Assuming that the fundamental factor determining sex is strictly a metabolic one, the writer, working in the Laboratory of Legal Medicine of the Royal University of Palermo, endeavoured first to determine in what the real nature of the sex cells actually consists, then, extending this idea to the sex of the matter contained in the cells, he attempted the solution of the other unknown factors more or less directly concerned with the fundamental question.

Following this method he first showed that sexual dimorphism cannot result from the action of the same factors in all species, and that the real crux of the question must be sought in various circumstances which, according to the particular case, act on the metabolism and consequently also on the sexual defferentiation, circumstances which are always different in the different species and of which part escapes detection.

(1) RUSSO crossed normal black rabbits (dominant) with Himalyan (recessive) and obtained, contrary to Mendelian expectation, almost all recessives and almost all females after the 1st generation of hybrids.

The nutritional hypothesis taken as a basis of sexual differentiation should, according to the writer, be understood as the product of the interaction of numerous and varied elements of the most diverse functional value all capable of being grouped under the heading of heredity and environment.

The factors which the writer has united in his researches include precisely the most important of those which biologists have applied separately in each case. He has succeeded by this method in obtaining for a long series of generations of different pairs of animals, litters exclusively unisexual, first all males and then entirely females from the same parents.

This method is now being applied to live stock (sheep, asses and cows) at the Agricultural Institute of Calstelnuovo and the Royal Zootechnical Institute of Luparello (Palermo).

321 – **The Inheritance of Coat Colours in Horses** (1). — ANDERSON, W. S. in *Kentucky Agricultural Experiment Station Bulletin* No. 180, pp. 121-145. Lexington, Kentucky, July 1914.

HORSES, ASSES AND MULES

In this paper the writer gives tables on the inheritance of coat colours in horses which include 14 055 matings or the colour of 42 165 horses. These data are obtained from STURTEVANT'S tables and the American Saddle Horse Register.

In the study of the hereditary connection between the various coat colours in horses, one great difficulty is found in the fact that the distinction between the three colours : black, brown and bay is not sharp. This uncertainty is the cause of a number of errors and inaccuracies in the registration of the colour of foals which account for most of the apparent anomalies in the transmission of coat colour by inheritance. Thus from the table drawn up by the writer, the inheritance of all the colours, with the exception of brown, appears clearly. In order to get over this difficulty the writer proposes to register simply mahogany brown as bay, and seal brown as black. In this way the appearance of brown where bay or black is expeeted could easily be explained.

Similarly, the question as to whether brown is recessive or dominant to bay, which is rendered so complicated by the confusion of these colours would no longer be raised. There would thus remain only six colours which according to the writer can be arranged in the following order : the three coordinate colours gray, roan and dun, dominant to bay, black and chestnut ; bay dominant to black and chestnut and black dominant to chestnut.

There being no records that would indicate the comparative strength of dun, roan and gray, these colours, for the present, are placed at the top of the list as of coordinate strength.

As to the question whether the coat colour is connected with other qualities of horses, there seems to be no evidence in support of this view. The factors which control the transmission of colour appear to be independent of all other qualities.

(1) See also *B.* 1913, Nos. 1057 and 1355; *B.* 1914, No. 144. (*Ed.*)

The laws governing the heredity of colours promise to be of value as an indication of the method for further research on the laws controlling the transmission of the other qualities of horses, and as assistance in putting the breeding of horses upon a more scientific basis.

As regards the colour of the hair, it is finally due, as suggested by KASTLE, to:

1. An oxiding enzyme of the nature of Tyrosinase.
2. The presence of an oxidizable cromogen as Tyrosin or some similar compound.
3. The extent to which the cromogen is oxidized by the enzyme.

As the oxidizable cromogen is present in the skin and hair, except possibly in albinos, the question is what determines the extent to which the cromogen is oxidized by the enzyme? As the inheritance of coat colours in horses is transmitted from generation to generation, that which determines the extent to which the cromogen is oxidized must reside in the germ cells. The name given to it is *factor* or *determiner*.

There are in animal coat colours, two kinds of white, one is dominant and the other recessive. It has been suggested by GORTNER that the dominant white is due to the presence of an inhibitory enzyme in the epithelial cells which prevents the action of the oxidase, and that recessive whites differ by not having the power to produce pigments. The recessive white lacks the chromogen or oxidase, or both. The latter, or albino white would of necessity be recessive in as much as it lacks the power to produce pigment and is without the means of inhibiting pigment production when the elements for its formation are present.

The writer then discusses the colours of human hair and lastly the subject of breeding horses to colour. The task is easy for the colour, which is recessive to all the others, namely chestnut, and more difficult the higher the degree of dominance of the colour desired.

CATTLE

322 – **Cow Testing and its Advantages.** — I. COLE. R. D. in *Department of Agriculture and Technical Instruction for Ireland*, Vol. XVI, No. 1, pp. 3-16, 6 tables. Dublin, October 1915. — II. Scheme for Encouraging Improvement in the Dairy Cattle of Ireland, *Ibid.*, pp. 153-159.

I. — The Department of Agriculture and Technical Instruction for Ireland introduced, in 1906, a scheme for establishing a register of Irish dairy cattle, under which the owners of officially selected cows undertook to keep one year records of the milk yield of each animal. At the end of the year all cows with a milk yield of a certain quantity and a certain butter-fat percentage were entered on the register or herd book. Bulls from such cows sired by pure bred Shorthorn bulls or by registered dairy bulls were subsequently inspected and those which came up to a certain standard were selected as eligible for premiums of £10 per annum. In 1912 the qualifications necessary for entry on the register were fixed at an annual yield of milk not below 6 000 lbs. with an average butter-fat percentage of at least 3 per cent. Having introduced the system in this way the Department next proceeded to establish cow testing associations. They accordingly, have appointed two instructors in cow testing, who attend

meetings of farmers and explain the objects and advantages of keeping milk records, and also the desirability of forming such associations. In order to encourage this work further, provision was made in connection with the scheme for Improvement of Dairy Cattle in Ireland for grants to cow testing associations which undertook to keep systematic records of both the yield and quality of milk. Under this system a number of farmers living in the same district join together and form an association with president, and secretary, or supervisor. The members undertake to weigh the milk from each cow morning and evening on one day each week during the milking period and, at the same time, take a small sample for the determination of butter-fat. The weight of the milk is entered by the farmer on a record sheet, which is sent by him to the supervisor together with the preserved composite samples at the end of the month. The supervisor is then responsible for the necessary tests for butter fat, entries and calculations etc. which will enable the farmer to know exactly what is the total quantity and money value of the milk produced by each cow in his herd during the month.

When an Association has been formed and the Department are satisfied that suitable arrangements have been made to carry out the work of the association, they supply the association with the necessary record forms free of charge, and also for at least one year, contribute at the rate of twopence per cow, per monthly test, towards the cost of testing for butter fat, provided the members contribute another penny per test, and that satisfactory records for at least 100 cows are kept throughout the year, and that the members are testing all the cows in their herds.

At the end of the milking period, on application being made, the Department are prepared to inspect all cows whose yields of milk and butter-fat are up to the necessary standard, and those which are of good conformation and of well-defined Shorthorn type are placed on the register of dairy cattle.

By means of such a system of cow testing with the gradual elimination of unprofitable animals, it is considered possible to raise the average milk yield of Irish cows by at least 200 gallons per cow, this would mean an extra income to the country of almost £6 000 000 per year.

II. — Provisions of Scheme No. 20 of the Department of Agriculture and Technical Instruction " for Encouraging Improvement in the Dairy Cattle of Ireland ".

Under this scheme the members of cow testing associations pay a much smaller proportion of the supervisor's remuneration than is the case in most other countries where milk records are kept. In Denmark the farmers pay (approximately) three-fourths of the cost of testing the milk, and the Government the other one-fourth, while in Ireland the Department pay two-thirds of this cost and the cow owners one-third.

The system of working cow testing associations in Denmark and some other countries is different from that practised in Ireland, inasmuch as under the Danish system it is usual to appoint a whole-time supervisor — or tester — to each association, and this man travels from one farm to another,

visiting each member about once a fortnight. Such a system can be strongly recommended provided the herds are large (provisions for associations scheme) but it would not be suitable in the case of associations where the herds are small and scattered over a wide area.

323 – **The Value of Barley for Cows Fed Alfalfa ; Experiments in California.** — True Gordon. H., Woll F. W. and Voorhies E. C. in *Agricultural Experiment Station Berkeley, California, Bulletin* 256, pp. 425-445. Berkeley, Cal. 1915.

These experiments were made by the writers in 1913-1914 at the Berkeley Experiment Station, in order to determine the effect produced upon the milk yield and the increase in the live weight of milch cows due to the addition of barley to a ration consisting wholly of lucerne. In the 1st experiment, 2 lots, each of 7 cows, were used ; the animals belonged to the following breeds: Jersey (2), Shorthorn (5) and Holstein (7). They were fed for 3 periods of 3 weeks alternately on 1) lucerne (green, and in the form of hay) ; 2) lucerne + ground barley. The cows received 30 lbs. of green lucerne per head daily, and lucerne hay *ad lib.* The barley was fed in proportion to the amount of milk produced, the ratio being approximately 1 pound of ground barley to every 5 pounds of milk. The average age of the 1st lot of cows was $4\,^{2}/_{7}$ years, and that of the 2nd $4\,^{5}/_{7}$ years, while the average number of months to the next time of calving was respectively 8.4 and 7.9. In order to accustom the cows to the rations they were to receive during the experimental period, a preliminary feeding of 6 days was introduced. The live weight of the animals was determined for 2 consecutive days at the beginning and end of the experiments, and the averages for each experiment were calculated. The results of the first experiment are given in Table I.

The increased production due to the addition of barley was thus 16 per cent in the case of milk, and 13 per cent in that of butter fat. While on lucerne and barley, the cows ate 42 pounds of barley and 12 pounds less of lucerne hay per head weekly than when on lucerne only. Taking this difference into account, and on the basis of milk selling at 16 cents per gallon and including the value of the gain in weight by the cows at 5 cents per pound, it is seen that a profit of $4.78 was secured per cow each week as a result of adding barley to the lucerne ration. If on the contrary, the price of the butter fat, instead of that of fresh milk, is taken into account, a loss of $5.62 for the cows during the actual feeding of barley is obtained.

In the 2nd experiment, the writers used two lots of 9 cows belonging to the following breeds : Holstein (10), Shorthorn (5), Jersey (2) and Guernsey (1). The average age of the cows of lot *A* was 5 ½ years and that of lot *B*, 6 years ; the average number of months to the next calving period was 2.7 and 8.1 respectively. This time, the experiment was divided into 2 periods each of 4 weeks duration. The other conditions were the same as those in the first experiment. The results are given in Table II.

The increase in the milk and butter fat production, as well as the gain in live-weight, were not sufficient to pay for the barley fed in addition to the lucerne, whether the calculations be based on the price of the whole

TABLE I. — *Results of Experiment I.*

| Periods of experiments | Lots of cows | Food consumed per cow weekly | | | Production per cow weekly | | | Average live weight per cow |
|---|---|---|---|---|---|---|---|---|
| | | Green Lucerne lbs. | Lucerne hay lbs. | Ground barley lbs. | Milk lbs. | Fat Per cent. | Fat lbs. | lbs. |
| July 24–30 | A | — | — | — | 201.2 | — | 6.95 | 1 058 |
| | B | — | — | — | 198.0 | — | 7.39 | 1 099 |
| August 6–26 | A | 210 | 152 | 45.1 | 212.5 | 3.5 | 7.40 | 1 059 |
| | B | 210 | 162 | — | 162.0 | 3.8 | 6.12 | 1 093 |
| August 27–September 16. | A | 210 | 146 | — | 172.9 | 3.6 | 6.15 | 1 070 |
| | | 210 | 126 | 39.6 | 160.8 | 3.7 | 6.40 | 1 117 |
| September 17–October 7. | A | 210 | 146.6 | 41.4 | 176.5 | 3.7 | 6.62 | 1 094 |
| | B | 210 | 151.9 | — | 138.2 | 3.8 | 5.34 | 1 133 |
| Average weight of lucerne and barley | A + B | 210 | 141 | 42 | 183.3 | 3.6 | 6.65 | Increase 24 |
| Averages of lucerne periods | A + B | 210 | 153 | — | 157.6 | 3.7 | 5.87 | 13.5 |
| Difference | | — | 12 | 42 | 25.7 | 0.1 | 0.78 | 10.5 |

TABLE II. — *Results of Experiment II.*

| Periods of experiments | Lots of cows | Food consumed per cow weekly | | | Production per cow weekly | | | Average live weight per cow |
|---|---|---|---|---|---|---|---|---|
| | | Green Lucerne lbs. | Lucerne hay lbs. | Ground barley lbs. | Milk lbs. | Fat Per cent. | Fat lbs. | lbs. |
| July 2–9 | A | — | — | — | 157.2 | 3.61 | 5.68 | 1 099 |
| | B | — | — | — | 155.9 | 3.80 | 5.93 | 1 159 |
| July 23–August 20 | A | 451 | 50 | 40.1 | 150 | 3.70 | 5.55 | 1 116 |
| | B | 565 | 45 | — | 138.4 | 3.74 | 5.18 | 1 174 |
| August 27–September 24. | A | 482 | 152 | — | 99.8 | 3.80 | 3.79 | 1 132 |
| | B | 428 | 141 | 40.5 | 119.7 | 3.85 | 4.61 | 1 206 |
| Averages of the periods of lucerne and barley | A + B | 440 | 95 | 40.3 | 134.9 | 3.78 | 5.08 | 1 161 |
| Averages of periods of lucerne | A + B | 523 | 98 | — | 119.1 | 3.76 | 4.48 | 1 153 |
| Difference | | 83 | 3 | 40.3 | 15.8 | 0.02 | 0.60 | 8 |
| Difference per cent. | | — | — | — | 16 | — | 13 | — |

milk or the butter fat. However, the immediate economic results obtained are not the sole criterion by which to judge of the economic desirability of adding barley to a ration of lucerne. On account of the favourable influence of grain feeding upon the condition of cows and their offspring it may be concluded that the practice of feeding barley to cows on lucerne is economically sound, and for this reason, it is recommended by the writers.

GOATS

324 - **Diuresis and Milk Flow.** — STEENBOCK, H. (Assistant Chemist, Agricultural Experimental Station of the University of Wisconsin) in *Journal of Agricultural Research* Vol. V, No. 13, pp. 561-568 Washington, D. C., Dec. 27, 1915.

The writer has experimented to ascertain the effect of well-known diuretics on the milk yield. Proof that these are able to influence milk secretion might lead to the discovery of a means to vary the proportions of the individual constituents of the milk.

Two goats in full milk were used as the experimental animals and were fed the following rations: Goat 1, weighing 95 lb., was fed daily a ration consisting of 2 lbs. of oats, 0.5 lb. of June-grass hay (*Poa pratensis*), 60 gm. of air-dried casein, 1 lbs. of fresh sugar beets (*Beta vulgaris*) and 2 gms of common salt. This provided sufficient energy and a sufficiently narrow nutritive ratio to serve excellently for milk production.

Goat 2, weighing 81 lb., was fed from 1.5 to 2 lb. of oats, 0.5 to 0.75 lb. of June-grass hay 1 gm. of common salt daily, though the latter was often refused. The specific diuretics used were sodium acetate, theocin, and sodium chloride. Neither of the first two substances when administered in reasonable doses provoke marked diuresis, the effects of urea and sodium chloride are described in the summary of conclusions. Data obtained during period of low consumption or of unusual restlessness on the part of the animal were discarded.

The conclusions are summarised as follows :

1) Urea administered in a diuretic dose is able to decrease temporarily the flow of milk. Upon repeated administration the increased intake of water which follows the impoverishment of the tissues with respect to water content balances the draft for water imposed by the diuretic, and the milk secretion comes back to normal.

2) Sodium chloride with its diuretic action as well as its laxative effect is unable to depress milk secretion under normal conditions, as it simultaneously evokes an excessive thirst, which increases the water intake.

3) With the decreased flow of milk caused by a diuretic the percentage of solids is increased. Fat is here the principal variable.

4) The mammary gland shows no tendency to absorb and put out subsequently in its secretion additional urea absorbed by the circulation.

5) It is difficult to interpret the results sometimes obtained with alfalfa hay as due to diuresis alone if urea diuresis can be taken as a type.

FORESTRY

325 - **Seventeen Years Selection of a Character Showing Sex-Linked Mendelian Inheritance.** — PEARL, RAYMOND (Biological Laboratory of the Maine Agricultural Experiment Station) in *The American Naturalist* Vol. XLIX, No, 586, pp. 595-608 2 tables, 1 fig. Lancaster, Pa., October, 1915.

In 1898 there was begun at the Maine Agricultural Experiment Station an experiment in breeding Barred Plymouth Rock fowls having for its

urpose the improvement by selection of the character " winter egg roduction "

The experiment has fallen into 3 divisions or periods, *viz* :

1) *Period from* 1898 *to* 1907. — This may be called the period of *mass election*. The plan followed here is the same as would be used in the building up of a first class dairy herd. Individual records of performances are kept. The large producers are mated with the sons of large producers in the hope of obtaining a race of improved layers. A certain minimum performance is required before a bird is " registered " There is no *test of the progeny* of particular matings with respect to their laying ability.

2) *Period from* 1908-1912. — In this second period the principle of *progeny testing* was introduced into the scheme of breeding. Further, selection was carried on for low production as well as for high.

3) *Period from* 1912 *to Date*. — During this period all selection for low and mediocre production was dropped.

The results of the 17 year selection period are set forth in Table I. The number of individuals involved amounted to nearly 5000.

TABLE I. — *Mean Winter Production per Bird of the Barred Plymouth Rock Flocks from* 1899 *to* 1915.

| Laying Year | Mean Winter Production of All Birds | No. of Birds Making Winter Records | Mean Winter Production of All Birds Selected for *High* Production | Mean Winter Production of All Birds Selected for *Low* Production |
|---|---|---|---|---|
| 1899–1900. . . . . | 41.03 eggs | 70 | — | — |
| 1900–1901. . . . . | 37.88 » | 85 | — | — |
| 1901–1902. . . . . | 45.23 » | 48 | — | — |
| 1902–1903. . . . . | 26.01 » | 147 | — | — |
| 1903–1904. . . . . | 26.55 » | 254 | — | — |
| 1904–1905. . . . . | 35.04 » | 515 | — | — |
| 1905 1906. . . . . | 40.65 » | 635 | — | — |
| 1906–1907. . . . . | 22.44 » | 653 | — | — |
| 1907–1908. . . . . | 19.93 » | 780 | — | — |
| 1908–1909. . . . . | 26.69 » | 359 | 54.16 | 22.06 |
| 1909–1910. . . . . | 31.76 » | 247 | 47.57 | 25.05 |
| 1910-1911 * . . . . . | 30.49 » | 264 | 50.58 | 17.00 |
| 1911–1912. . . . . | 35.93 » | 232 | 57.42 | 16.43 |
| 1912–1913. . . . . | 43.01 » | 182 | 52.61 | — |
| 1913–1914. . . . . | 52.20 » | 192 | 52.20 | — |
| 1914-1915 * . . . . . | 45.89 » | 179 | 45.89 | — |
| Totals and Means. . . | 35.05 eggs | 4 842 | 51.49 | 20.14 |

* The decline in these 2 years was due to unfavourable environmental influences, for instance, in 1914 an inexperienced man was in charge of the incubation and rearing.

Broadly speaking the experiment has shown that mass selection fo production was not effective while selection which was based upon the pe formance of the progeny *was* extremely and quickly effective. As regard the explanation of these differences any interpretation which bases its ex planation of the results on environmental action may be definitely pu aside. To the writer, the essential key-note to the explanation of the re sults of this long experiment is found in the fact that *phaenotypic* varia tion of the character fecundity, in fowls, markedly transcends in extent an degree, *genotypic variation*. It is impossible in the great majority of case to determine with precision what is a hen's genetic constitution with respec to fecundity from an examination of her egg record alone.

Thus the reason why no effect was produced during the first 10 year of selection and a marked effect during the last seven was because geno typically high producers were *uniformly* selected during the latter period an not so selected in the former. Mass selection on the basis of performance (phaenotypic appearance) is in its essential nature a blind and haphazard process just so long as the correlation between the gametic and somatic conditions of the character is not perfect. And it is an outstanding fact o the Mendelian investigations of the last 15 years that the gamete-soma cor relation is very rarely, if ever, perfect.

It appears on this view that selection for high egg production in the fowl is effective when it is real. That is, if one selects *genetically* high pro ducers by means of the trap-nest *plus* the progeny test a high producing strain is fixed very rapidly. If on the other hand high layers are selected merely by the trap-nest record alone, selection is not really made of genetic ally high producers except in a portion of the cases.

In discussing the bearing of the results of the experiment upon the gen eral problem of the effectiveness of selection in modifying germinal deter miners, the writer denies that there is any evidence whatsoever for assuming that through the process of selection the hereditary determiners of fecundity either have been or can be changed. All that selection has done is to change the constitution of the *population* in respect of fecundity genotypes.

326 - **Squab Raising in the United States**. — LEE, ALFRED B. (Animal Husbandman in Poultry Investigations, Animal Husbandry Division) in *U. S. Department of Agriculture, Farmer's Bulletin*, N° 684, 16 pp. 9 figs, Washington, September 1915.

A list of questions on pigeon raising was sent by the United States Bureau of Animal Industry to pigeon breeders throughout the United States and, among others, replies were received from 22 large breeders who kept from 300 to 2 200 pigeons and produced squabs for market. A large num ber of replies were received from breeders who kept less than 300 pigeons. Their answers in general agreed with those from the large pigeon breeders, although they were more varied.

From the above enquiries and from data supplied by the writer, it appears that pigeons are kept in all parts of the United States, but most of the large squab-producing plants are to be found near the large cities in the North eastern States and on the Pacific coast. Many pigeons are kept as a side issue on general farms in the Middle West and South. Prolific

pigeons producing large squabs are mostly kept confined in pens, while common pigeons which are less prolific and produce smaller squabs of a poorer quality are kept on the general farms and are usually allowed their freedom.

Most of the large successful pigeon farms make a business of selling breeding stock and are not devoted primarily to the production of squabs for market. The large squab producers raise almost exclusively pigeons of the Homer and Carneaux varieties, and on a smaller scale some Dragon, White Maltese or Hen, and White King. All of them except one keep their pigeons confined. The birds are mated at the age of 5 to 7 months, the average being 5.7 months.

Wheat, maize, kafir corn, Canada peas, millet and hemp were the grains most commonly fed, while peanuts, grass seed, oats, buckwheat, sunflower seed, rice, cowpeas are also used. About one-half of the breeders reported the use of some kind of green food including a wide range of such material. Rock salt was used by one-half of the breeders, loose table salt by one-fourth and table salt in hard lumps by the rest. About 16 per cent used some extra feed such as millet or hemp during the moulting period, while several who did not use any special feed for assisting the moult supplied these grains in their regular rations. One third used hoppers in feeding the pigeons.

About one-half supplied tobacco stems as the entire, or for part of the nesting material, and hay and straw were commonly used while others used pine needles, pea vines and alfalfa stems. One-half reported freedom from all diseases and about one-fourth gave canker as a common cause of sickness.

The diseases most commonly reported by small breeders were canker, "going light" and roup. The principal method of treatment was prevention: by keeping everything clean, using disinfectants and killing sick or diseased pigeons. The remedies used were kerosene oil, permanganate of potash, lime, copper sulphate, carbolic acid, quassia chips, Epsom salts, Venetian red, tincture of gentian, or a tonic in the drinking water. Dry sulphur and diluted peroxide of hydrogen were used for treating canker, and kerosene oil for roup.

All the large breeders sold squabs for market while about one-half sold also as breeders. Of the small breeders fifty-five per cent sold squabs for market only, 33 per cent for market and as breeders, and 12 per cent for breeders only.

Large breeders marketed their squabs at four weeks, except from two farms where they sold them at four and one-half weeks. Small breeders marketed at from three to six weeks, the average being 4.2 weeks. The number of squabs marketed from each pair of breeders varied in the small farms from 5 to 22 and averaged 13.8 and the weight per dozen squabs varied from 4 to 18 pounds, while the large breeders marketed 10 to 20 squabs from each pair of pigeons and averaged 13.1, and the weight of their squabs ranged from 6 to 11 pounds per dozen and averaged 9 pounds. The average price for the year per dozen squabs varied from $ 2 to $ 4.62 and aver-

aged $ 3.43 for the large breeders while for the small ones the figures were $ 0.60, $ 6, and $ 3.01 respectively. The former made an average yearly profit from each pair of breeders which varied from 32 cents to $ 3 and averaged $ 1.52, while the profit of the small farms was between 20 cents and $ 7.50 and averaged $ 2.29. and the profit from breeders who sold stock largely for breeding purposes varied from $ 10 to $ 20 per pair.

The feed cost for large breeders was from 95 cents to $ 2 per pair of breeders and averaged $ 1.32 ; for small breeders it varied from 40 cents to $ 4 and also averaged $ 1.32.

An average yearly profit of $ 1.50 per pair of breeders is considered good on successful plants producing only squabs for market. The demand for squabs, especially in large cities, is gradually increasing. The supply, however, appears to keep pace with the demand, judging from the average price.

SILKWORMS

327 – **Orientation of the Mature Silkworm in the Act of Spinning its Cocoon.** — RAVENNA, G., in *Informazioni Seriche*, Year II, N° 25, pp. 660-661. Rome, December 6, 1915.

In 1914, experiments were made at the Royal Experimental Silk Station of Padua to test the conclusions of MM. MOZZICONACCI and KATÔ. For this purpose Russian breeds were chosen as being better adapted on account of their rather elongated cocoons. According to these writers a vertical position of the chrysalid in the cocoon is injurious and should be prevented. In this position the last abdominal segment of the insect would be flattened and completely deformed by the pressure, thus interfering with the copulation of the moths and the production of eggs, which would also lack fecundity.

The following results were obtained :

1st Lot. — Breed "*Orange de Terek*". Cocoons of very dark orange yellow colour, rather elongated, with one end very pointed.

2nd Lot. — Breed "*Orange de Kakhetie*". Cocoons generally of a very dark orange yellow, irregular oblong shape, pointed at one end.

3rd Lot. — Breed "*Vert de Terek*". Cocoons of a more or less dark green colour, elongated, pointed at one end.

It was observed that on the bunches of twigs the cocoons of all three lots had always the pointed end turned downwards. Fifty cocoons of each type were opened and it was found that in all cases the head of the chrysalid corresponded to the blunt and rounded end of the cocoon which pointed upwards.

It was therefore supposed that the constant position of the chrysalid was due to the particular shape of the cocoon and that it was desirable to repeat the experiment with two breeds of different shape viz : the white and green breeds of Marhellan. In the former the shape of the cocoons approaches that of the Japanese breeds, in the second that of the Chinese. Here again it was shown that the head of the chrysalid naturally corresponds to the upper part of the cocoon. After the escape of the moths from two specimens an abundance of fertile eggs was obtained.

The results therefore do not support the hypothesis of MM. Mozzicoacci and Katô ; besides, this latter had been contradicted by M. Verson as early as 1894.

28 - **Phototaxy in Silkworms.** — Acqua, C. in *Informazioni seriche*, Year IV, N° 1, pp. 1-3. Rome, January 10, 1916.

*Phototaxy* is the movement of animals and plants in response to light. It is distinguished from *phototropism* in that the former term implies the movement of the entire individual whilst the latter is applied to movements of portions of the individual.

These experiments were particularly designed to determine if the vigour of the newly born larvae accounts for the increased response at this stage.

Experiments were made 1) on newly-born larvae deprived of food; 2) on larvae of various ages allowed to feed ; 3) on moths.

The results obtained are as follows :

Newly born larvae show active positive phototaxy and are only slightly affected by the intensity of illumination and not at all by quality of the rays. This response appears to be related to the vigour of the larvae. It diminishes subsequently and disappears at the end of the first stage. In the subsequent stages there is a vegetative phototaxy, less vigorous however, than that shown at birth, but similar to it in not being affected by the colour of the light rays. The moths show no phototaxy at all.

The writer proposes in subsequent researches to study positive phototaxy in various breeds, and to ascertain if it is possible to determine the vigour of the newly born larvae with a view to obtaining practical means of selection.

29 - **The Hydrobiological Station at Davos.** — Fehlmann J. W. in *Schweizerische Fischerei-zeitung*, Year 23, N° 12, pp. 332-334. Pfäffikon (Zurich), December 1915. PIGS

On October 10, 1915, the first Swiss hydrobiological Station was inaugurated at Davos. The Station was founded by the exertions of the Inspector of Fisheries of the district of Davos, with the financial support of the authorities of the district, and under the direction of the " Kurverein " of the health resort. It will serve provisionally as a laboratory for the two scientists who for the past year have been occupied in making a botanical and zoological survey of the lake of Davos. The Station, however, is equipped with all the necessary apparatus for carrying out the most difficult hydrobiological and piscicultural research. With its two laboratories, and its situation close to the breeding ponds and lake, the new institution offers great advantages for a survey of the Alpine lake fauna and flora. Sufficient funds have now been obtained for the formation of a similar Station on the shore of Lake Lucerne.

30 - **Fish Culture as a Means of Using Alkaline Land in Hungary.** — Répassy, M., in I. — *Vizügyi Közlemenyek*, Year V, Part. 5, pp. 131-138. Budapest, December, 1, 1915. II. — *Halaszat* (Pisciculture), Year XVI, N° 23, pp. 240-243. Budapest, December 1, 1915.

The immense tracts of alkaline land which form part of the great Hungarian Plain (Alföld) can be improved and reclaimed by means of irrigation,

as has been proved in convincing fashion by the numerous experiments carried out on alkaline meadows and pastures at Bekescsaba by the Experiment Station of Magyaróvár. With regard to these results (1), many workers have drawn attention to the construction of fish ponds as a useful method of using very alkaline land useless for cultivation.

As early as last century it was observed in fish breeding under natural conditions that the waters of alkaline soils are very favourable to the breeding of fish. In fact, the water of lake Balaton, the most important lake of Hungary as regards fish-culture, is alkaline. But Lake Palics is still more remarkable in this respect. The writer tabulates the results of 7 years working (1899-1905), from which data it is seen that the annual yield of Lake Palics per acre (it has an area of 1003 acres) varies between 136 ½ and 161 lbs. In view of this success, and the great impetus that has been given to fish-culture in Hungary during the last 20 years, the construction of artificial ponds has been begun on alkaline land. Fish culture is better than irrigation for the improvement and utilisation of alkaline land. The excellent results obtained are summarised as follows :

1) In ponds with alkaline water, the production of plankton is normal.

2) Fish-culture requires a smaller water supply than irrigation, for the latter has to be carried out in relatively short periods of time, and if the water is insufficient the success of the crop is doubtful. Water is most needed at the beginning of spring, when the ponds that have been dried for the winter require filling, this is generally done between February and April, at which season the river floods afford a plentiful supply. The loss of water in these ponds is very small, for the alkaline soil hinders infiltration and the supply is therefore only diminished by evaporation.

3) In the matter of manuring, fish-culture is also less exacting than irrigation. Owing to the part played by the water, it is easier to manure the bottom of the ponds than to manure irrigated alkaline soil. Further, the mud left by the spring floods is an excellent fertiliser, while the muddy water, when afterwards turned into the ponds, does no harm to the fish. In addition, the cattle that are periodically watered at the ponds, the droppings of aquatic birds, the heavy showers washing the adjacent cultivated land, artificial feeding etc., furnish the ponds with fertilising substances all tending to increase production.

4) In addition to the advantages to be derived from the presence of fish ponds on arid land, another advantage of pisciculture lies in the leaching action of large sheets of water. Very alkaline soils that are systematically covered with water are changed and improved in the course of some years, so as to become suitable for any agricultural crop.

The writer gives characteristic data relating to the 5 chief fish-breeding establishments on alkaline land; these have been exploited for some years. The areas of these 5 ponds are respectively : 1944 - 1050 - 262 - 889 acres ; they supply the market annually with 176,000 - 220,000 - 50,600 - 10,000-

(1) See *B.* January 1913, N° 15. (*Ed.*).

1192 lbs. Mention is also made of the working of 6 ponds, each of about 8 ½ acres (on the Törökka estate). These were constructed on patches of alkaline soil, in order to make them suitable for cultivation. In the course of 4-5 years, the removal of the alkaline substances by the water has so greatly improved the soil, as to allow of the following crops being grown upon it : wheat (with a yield of over 22 cwt. per acre), maize for forage and sugar beets (with a yield of 403 cwt. per acre).

On the strength of these results, the first attempts towards the exploitation on a large scale of the " Puszta Hortobagy " (the largest steppe of the great Hungarian Plain (1) were made. Of the 4260 acres of alkaline land reserved by the State for irrigation trials, 2840 acres have been set apart for Fish-breeding Stations. The water is brought to these ponds by a conduit 11 ½ miles long. The writer considers that these Stations should carry out a number of experiments on questions relating to the improvement of alkaline soils, as these problems are of great practical importance to the agriculturists of the arid regions. Thus he recommends : manurial experiments with chemical fertilisers ; experiments in ploughing and harrowing the bottom of the ponds, in order to accelerate the decomposition of nutritive substances, and the removal, by washing, of injurious salts, etc.

## FARM ENGINEERING.

331 – **Implements and Machinery at the Smithfield (London) Show, December 1915.** — *The Implement and Machinery Review*, Vol. 41, No. 489, pp. 1041-1075. London, January 1, 1916.

AGRICULTURAL MACHINERY AND IMPLEMENTS

This account contains a brief description with some illustrations of the most noteworthy exhibits seen at the 117th show of the Smithfield Club which was held in London from the 6th to the 19th of December 1915.

Motor ploughs, agricultural motors, steam and petrol lorries, steam tractors and milking machines were the classes of machinery which received the closest attention from the public.

During the week, well attended meetings of the Smithfield Club, Royal Agricultural Society of England, National Traction Engine Owner's and User's Association, etc. were held.

The following are some of the firms represented and a few of their most important exhibits.

Hornsby & Sons : a new mower ; and a 10 ½ HP. oil engine which burns either refined petroleum or almost any kind of crude gas or residual oils.

John Fowler & Co. : a 12 HP. compound steam ploughing cable engine ; a special deep anti-balance plough which is convertible to cut either four furrows 12 in. wide and 8 in. deep, or three furrows 16 in. wide and 12 in. deep. It is also provided with special revolving disc skimmers on

(1) See *B.* May 1913, N° 441. (*Ed.*).

roller bearings to cut and turn under all surface growth ; Fowler-Wyles self-propelled motor plough with the latest improvements. It has proved itself capable of all general farm work and especially for work in orchards, vineyards, rubber and other plantations.

R. GARRETT & SONS : a superheated steam motor wagon and a compound steam tractor. By the use of superheated steam a 25 to 30 per cent. saving of fuel and water is effected, while the vehicle can travel an unusually long distance without having to take up fuel and water.

CORBETT, WILLIAMS & CO. : a very simple 3 ½ HP. oil engine to which no heed need be paid after starting, except for oiling once or twice during a day's work.

ROBEY & CO. who have built 35 000 engines since 1852 : a 5-ton compound steam motor wagon with a number of recent improvements.

AVELING & PORTER : a splendidly built compound ploughing engine and a 3-ton lorry for running at 12 miles an hour.

FODENS, LTD. : a 3-ton compound steam wagon on rubber tyres, in which the horizontal multitubular boiler is fed by a novel friction pump of which drivers speak very highly. The running costs of the wagon are remarkably low.

BRISTOL WAGON AND CARRIAGE WORKS CO: Victoria petrol engines of simple construction specially suitable to withstand hard work under the varying conditions of farm usage.

MARSHALL, SONS & CO. : Oil engines, 6, 16 and 25 HP. They burn completely almost any commercial quality of paraffin, or oil fuel residuals and crude oils.

CLAYTON & SHUTTLEWORTH : 5-ton steam wagon and a 3 to 4-ton petrol wagon with a 45 HP. vertical engine which runs at a 1000 revolutions per minute. Four speeds forward and one reverse are provided for.

MANN'S PATENT STEAM CART AND WAGON CO. : a light steam agricultural tractor which is equally efficient for ploughing, harvesting, driving a thresher in combination with a straw elevator or chaff cutter besides being capable of driving any other farm machinery and hauling loads along roads.

WM. ALLCHIN, LTD. : a 3 to 4-ton steam wagon, in which the compound engine may in case of necessity be instantly converted into a double high pressure engine. It can carry water for a 40 miles run and coal for 70 miles.

BLACKSTONE & CO. : an engine capable of working on all kinds of crude oils as well as petroleum residue and developing a maximum amount of power with a minimum of cylinder volume. The same firm exhibited a swath turner in which the tines are individually free to follow the surface of the ground and thus the machine works equally well on the steepest ridge and furrow as on flat land, without any strain on the mechanism.

W. FOSTER & CO. : a 7 HP. single-cylinder traction engine equipped for a working pressure of 150 lbs. and especially suitable where simplicity is required.

RUSTON, PROCTOR & CO. : a 10 HP. "convertible" internal combustion engine which, with a slight alteration, may be readily converted to work upon benzol, petrol, paraffin and similar fuels or producer or town gas.

Much interest was raised by the "Ruston" safety canvas self-feeder for threshing machines (See fig. 1) for the addition of this apparatus to any thresher reduces the number of attendants required. It consists of a light wooden casing fixed at the drum mouth, affording complete protection to the attendant and rendering the scattering of the grain impossible. The sheaves are carried forward on an endless canvas driven by a pulley on the shaker crank.

Whole sheaves cannot enter the drum owing to the presence of a series of steel prongs which separate the straw.

EAGLE ENGINEERING CO. : simple and reliable motors which start on petrol and then use paraffin and are, therefore, very economical to run.

PETTERS LTD. : light agricultural 10 HP. tractor, of the semi-Diesel

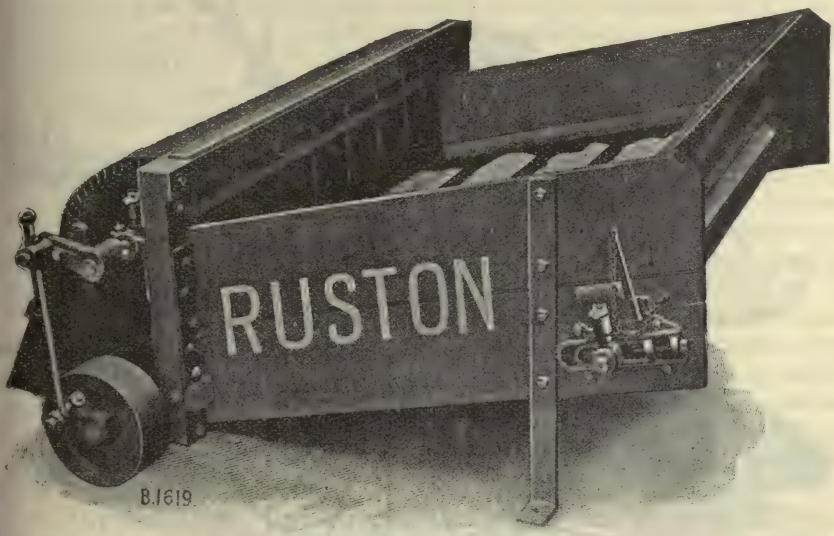



Fig. 1. — "Ruston" safety canvas self-feeder for threshing machines.

type, designed to haul and operate any farm implement with only one man in attendance, who is able to steer the tractor by means of reins whilst seated upon the plough, mower or other machine to which it may be attached.

DETROIT ENGINE WORKS: "Farmer's Special," general purpose, surprisingly low-priced, economical and thoroughly serviceable farm engines. They run on petrol only.

RANSOMES, SIMS & JEFFERIES : a heavy four furrow tractor plough for heavy land. The steerage of the land and front furrow wheel is operated by a single lever, and the hind furrow wheel is also operated by a lever.

R. E. GLANVILLE : Syracuse reversible riding one way plough (fig. 2), which any boy or girl can manage. It possesses two bodies mounted on separate beams, one turning the furrow to the right and the other to the left.

The plough is raised by a foot trip or hand latch on the lever which transfer the labour of raising the plough to the team, and leaves the driver free t manage the draught animals while turning. After having turned, th other plough is turned, the whipple-trees slide automatically into plac at the end of the long clevis so that the implement follows the line of draught.

The same firm exhibited the "Eureka" potato planter which open the furrow, distributes the manure, drops the potato and covers it up i one operation.

SAUNDERSON AND MILLS: "Universal" tractors for all the work on a farm usually performed by horses. — The 20 HP. model G hauls 5 to tons on a good road at 5 miles an hour consuming about 1 gallon of fuel pe

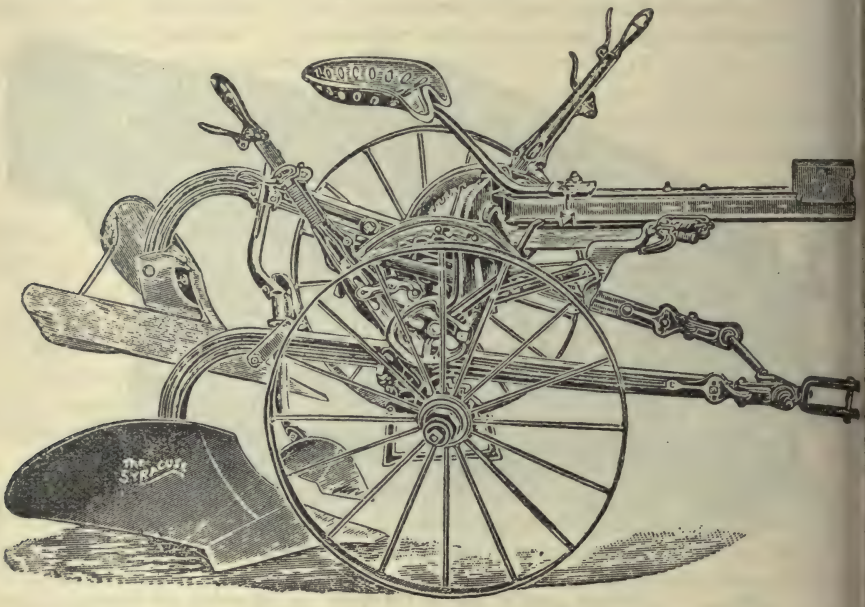



Fig. 2. — "Syracuse" Reversible Riding One Way Plough.

20 ton-miles. Under average conditions it will draw a 3 or 4-furrow plough 6 in. deep up to three quarters of an acre per hour on three gallons of fuel. Petrol, gasoline, benzine alcohol or common petroleum may be employed.

WYLES MOTOR PLOUGH CO.: an 11 HP. double furrow plough which can work to a depth of 12 in. and to a maximum width of 14 in.

MARTIN'S CULTIVATOR CO: a two furrow motor plough which in a few minutes can be converted into a farm tractor. It is propelled by two endless track creepers, each being adjusted independently, so that one runs in the furrow and the other on the land. At the speed of three miles per hour

t will plough three acres a day with a petrol consumption of about two gal-ons per acre.

J. COLLINGS: a compound superheated steam tractor and a new four-urrow plough fitted with a special automatic lifting gear by which the ower of the tractor is utilised to lift the plough at the head lands. The epth of work may be regulated when the plough is in motion. This im-lement may be used independently or as one unit of Collings' combined ultiple plough harrow, roller and seed drill for direct traction, to the whole f which outfit one man can easily attend.

E. N. BENTALL & Co.: "Pioneer" petrol engine and several com-ined mills for crushing, grinding and kibbling fitted with springs to allow ard substances passing through without damaging the plates.

OVERTIME TRACTOR Co.: a farm tractor which is said to do the work f eight strong horses; with a three furrow plough it will turn over 7 acres er day at a cost of 14s., it is serviceable also for cultivating harvesting and riving machinery.

MILLS AND SONS: The "Sandusky" American petrol farm tractor, a trongly constructed, powerful, well finished 40-45 HP. machine for plough-ng, threshing and hauling on roads.

IVEL AGRICULTURAL MOTORS LTD.: Ivel agricultural tractor, with the atest improvements, among which a system of forced lubrication to all the orking parts; it is of 24 HP. and will haul a 2 or 3-furrow plough two inders, two mowers etc., or drive any other farm machinery at a remarkably ow working cost.

INTERNATIONAL HARVESTER CO. OF GREAT BRITAIN: "I. H. C." and "Mogul" stationary and portable engines and "Mogul" oil tractors to-gether with ploughs, one of which was provided with an arrangement which by pulling a cord automatically lifts the plough bodies. The whole outfit is thus controlled by one man.

C. BURRELL & SONS: a fine steam tractor in which each hind wheel is driven separately, so that there is no strain through the axle.

W. WEEKS & SONS: "Simpler" agricultural 22½ HP. petrol tractor. It is speeded to 2,4 or 6 miles per hour as well as reverse, and it is service-able for ploughing or hauling other tilling or harvesting machines or driving machinery. It is only 4 ft. wide and can thus be used between narrow rows in plantations.

W. BALL & SONS: "Criterion" ploughs and farm lorries.

BARFORD & PERKINS: a motor roller with "Cambridge" pattern rings which travels at speeds from 2 to 4 miles an hour on any land. It is made in widths of 5 ft. and 6 ft. but trailing rollers may be attached to give a rolling width of 10 ft. The weights of the rollers may be increased by filling them with water.

KEARSLEY & Co.: several mowers among which one with two speeds for varying crops

A. & W. POLLOCK: "Perfect" potato digger wherein the digging forks retain a vertical position when working and closely imitate the action

of hand labour. The "throw" of the forks can be varied to suit different kinds of soil and the share, prongs, wheels, pole etc. are also adjustable.

JOHN WALLACE & SONS : Champion potato digger fitted with the new adjustable graips or forks which can be set at almost any angle to suit all kinds of soil and which eliminate any liability to damage large tubers.

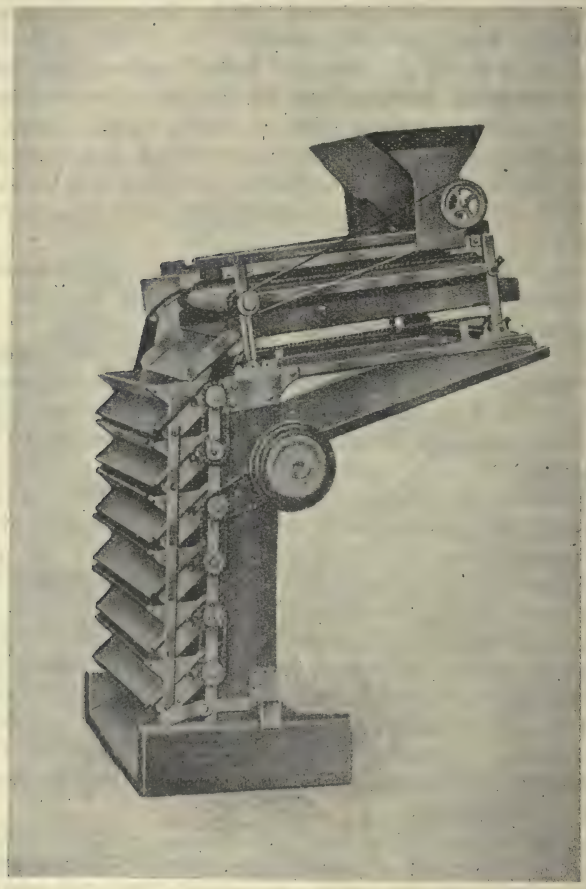


Fig. 3. — "Challenge" Seed-Dresser.

WM. FENEMORE : hay loader and hay holder, which save a good deal of time and labour. The hay loader works equally well on ridge and furrow as on level land and it will take up hay as left by the horse or side rake. Any farm vehicle can be used with it and it requires only one man to attend to it.

MALDEN IRON WORKS CO. : Mugleston's hay sweep, collects the hay either as left by the hay maker, swath turner or hay rake and takes it to the stacking elevators without needing carts or wagons. It requires only two horses and a lad. It clears a width of 14 ft. and equally well on level and on uneven ground. For travelling along roads it can be turned into a vertical position reducing the width of the machine to 7 ft.

G. C. OGLE & SON : a new elevator for building stacks of hay or straw. It can be fixed for work in 15 minutes by a man and a boy and will deliver a two horse cart load of hay on the top of the stack within five minutes.

MASSEY-HARRIS : a new implement : the "stiff tooth cultivator" with safety spring trips to prevent breakage when the teeth meet with obstructions, the teeth returning to their normal position when the obstruction is passed.

F. M. DOSSOR : the "Challenge," quite a new departure in seed dressers, for clover and small seeds. The work is done by a series of overlapping belts with covers and hoppers which check and redistribute the seed to each section. Each sieve is capable of two motions, jumping or vibratory, and is brushed clean about ten times a minute by its automatic cleaner.

J. A. PEMBERTON : hog motor and feeder. This machine compels pigs to grind their own grain as they eat. It is a metal cylinder with a hopper at the top which holds 4 ½ bushels of grain. The cylinder is rotated by the pig using its snout, pressing it against wooden projections attached to the cylinder and resting on a tray. The ground feed is distributed evenly, thus ensuring each animal an equal amount of food. It is claimed that its employment saves 25 per cent of the grain fed.

J. S. MILLAR : "Superior" churn in which the body of the churn is of earthenware which cannot absorb any injurious matter and can be washed and dried very quickly.

Other churns were shown by T. BRADFORD & Co. and by WAIDE & SONS.

Milk separators were exhibited by the WOLSELEY S. S. MACHINE Co., the DAIRY SUPPLY Co., G. LLEWELLIN & SON, the ALEXANDRA SEPARATOR Co., J. S. MILLAR & Co., POND & SON, PERFECT DAIRY MACHINES Co., and the MELOTTE SEPARATOR Co.

The milking machines on view were : the "Vaccar" constructed by the VACCAR MILKING MACHINE Co., A. R. LESTER & Co.'s milking plant and the "Amanco" of the ASSOCIATED MANUFACTURERS' Co. which will milk seven to nine cows per hour, and one man can thereby milk from twenty to twenty five cows per hour.

332 – **Review of Patents.**

*Tillage machines and implements.*

Canada

164 761. Harrow.
165 247. Rake.
165 531. Pulverizer and packer for earth.
165 716. Harrow tooth.

France 478 068. Portable hand plough.
478 421. Rotary tilling machine.
Sweden 39 328. Hand rake.
39 434. Rotary tilling machine.
Switzerland 71 561. Implement for making holes in the ground for seeds or plants.
United Kingdom 19 242. Apparatus for raising agricultural machines by the pull of the draught chain.
19 519. Hand implement for weeding and thinning plants.
19 588. Device for vertically adjusting the tool frame relatively to the wheels in motor ploughs and cultivators.
United States 14 017. — 1 160 686 — 1 163 143. Gang ploughs.
14 018. Means for operating gang-ploughs.
1 160 743. Wheeled plough.
1 161 114 — 1 161 674 — 1 161 964 — 1 162 068 — 1 162 544. Cultivators.
1 161 143. Rotary plough.
1 161 215. Beet plough.
1 161 241. — 1 161 825 — 1 161 919 — 1 162 401. Ploughs.
1 161 534. Power operated plough.
1 162 013. Harrow.
1 162 077. Cultivator or other vehicle having manually controlled steering wheels.
1 162 332. Disk-harrow.
1 162 457. Deep tilling gang plough.
1 162 842. Subsoiler attachment.
1 162 902. Roller cultivator.
1 163 240. Cotton chopper.
1 163 586. Weeder attachment for cultivators.
1 163 895. Motor plough.
1 164 147. Plough attachment.
1 164 308. Traction plough.
1 164 390. Gang plough hitch.
1 164 543. Wheeled cultivator.

*Manure distributors.*

United Kingdom 19 701. Manure and seed distributing attachment to a disk harrow.
United States 1 160 688. Attachment for manure spreaders.
1 161 371 — 1 162 903 — 1 164 579. Fertilizer distributor.
1 163 013. Straw spreader.

*Drills and sowing machines.*

Sweden 39 436. Device for potato setting machine.
Switzerland 71 561. Implement for making holes in the ground for seeds or plants.
United States 1 160 887 — 1 161 560. Potato planters.
1 161 298 — 1 162 526. Corn planters.
1 164 393. Corn planter marker.

*Reapers, mowers and other harvesting machines.*

| | |
|---|---|
| Canada | 165 143. Harvester. |
| | 165 191. Shocker. |
| | 165 665. Hay dumping rack. |
| Netherlands | 482. Mowing machine for water plants. |
| United Kingdom | 18 422. Improved fingers for mowing machines. |
| | 18 957. Lawn mower. |
| | 19 268. Flax pulling machine. |
| United States | 1 160 696. Grain harvesting machine. |
| | 1 160 759. Kafir corn header. |
| | 1 160 777. Corn husking and harvesting machine. |
| | 1 161 252. Ensilage harvester. |
| | 1 161 758. Grain elevator. |
| | 1 162 869 — 1 164 306. Harvesters. |
| | 1 162 981. Corn shock harvester. |
| | 1 163 237. Attachment for harvesters. |
| | 1 164 133. Self-dumping hay rake. |

*Machines for lifting root crops.*

| | |
|---|---|
| Canada | 164 917. Harvester for beets. |
| Sweden | 39 378. Implement for cleaning and separating root crops. |
| United States | 1 163 348. Potato digger. |

*Threshing and winnowing machines.*

| | |
|---|---|
| Canada | 165 169. Grain separator. |
| Sweden | 39 358 — 39 602. Winnowing machine. |
| United States | 1 163 513. Threshing machine. |

*Machines and implements for the preparation and storage of grain, fodder, etc.*

| | |
|---|---|
| Canada | 164 805. Grain grinder. |
| Italy | 148 927. Straw baling press. |
| Sweden | 39 378. Implement for cleaning and sorting root crops. |
| United Kingdom | 19 133. Machine for pearling or polishing rice and other grain. |
| United States | 1 161 211. Potato screening and sorting machine. |
| | 1 162 817. Portable grain elevator. |
| | 1 163 033. Hay and grain loader and carrier. |
| | 1 163 123. Hay retainer for hay stacker. |
| | 1 163 250. Baling press. |
| | 1 164 121. Hay press. |
| | 1 164 404. Feeding device for hay presses. |

*Dairying machines and implements.*

| | |
|---|---|
| Canada | 164 879. Centrifugal separator. |
| | 164 881. Butter forming machine. |
| | 164 889. Apparatus for milking cows. |

| | |
|---|---|
| | 164 941. Safe for milk. |
| | 165 394. Churn. |
| | 165 490. Cream separator and churn. |
| Cuba | 2 367. Vessel for the carriage of milk. |
| Sweden | 39 329. Churn. |
| | 39 359. Bearings for shaft of separators. |
| | 39 360. Device for suction milking machines. |
| | 39 437. Milkstrainer. |
| | 39 603. Arrangement of plates in separators. |
| Switzerland | 71 583. Device for the carriage of dairy produce. |

*Other agricultural machines and implements.*

| | |
|---|---|
| Canada | 164 795. Basket trimming machine. |
| | 164 876. Machine for making plough point moulds. |
| | 165 039. Straw feed mechanism for stores. |
| Cuba | 2 350. Improvements in the mechanism for regulating the pressure of the crushers in sugarcane mills. |
| | 2 355. Improvements in sugarcane mills. |
| | 2 368. Automatic filter for sugarcane juice. |
| | 2 369. Apparatus for treating sugary juices with sulphur dioxide. |
| | 2 370. Method of clarifying sugarcane juices. |
| France | 477 337. Curry-comb. |
| | 478 782. New process for pulverising bones for their direct use in agriculture. |
| Sweden | 39 435. Agricultural tractor. |
| Switzerland | 71 571. Device for broaching and drawing off liquids, especially unfermented fruit juices. |
| | 71 572. Cask bung with means of preventing the entrance of germs of fermentation into the cask and its refilling. |
| United Kingdom | 18 360. Apparatus for treating carcasses etc. to form meat meal or manure. |
| | 19 274. Machine for peeling osiers. |
| | 19 380. Apparatus for extracting hops. |
| United States | 1 162 946. Steering and draught apparatus for trailers. |
| | 1 163 379. Draught equalizer. |
| | 1 166 208. — 1 164 307. Tractors. |
| | 1 164 310. Traction machine. |

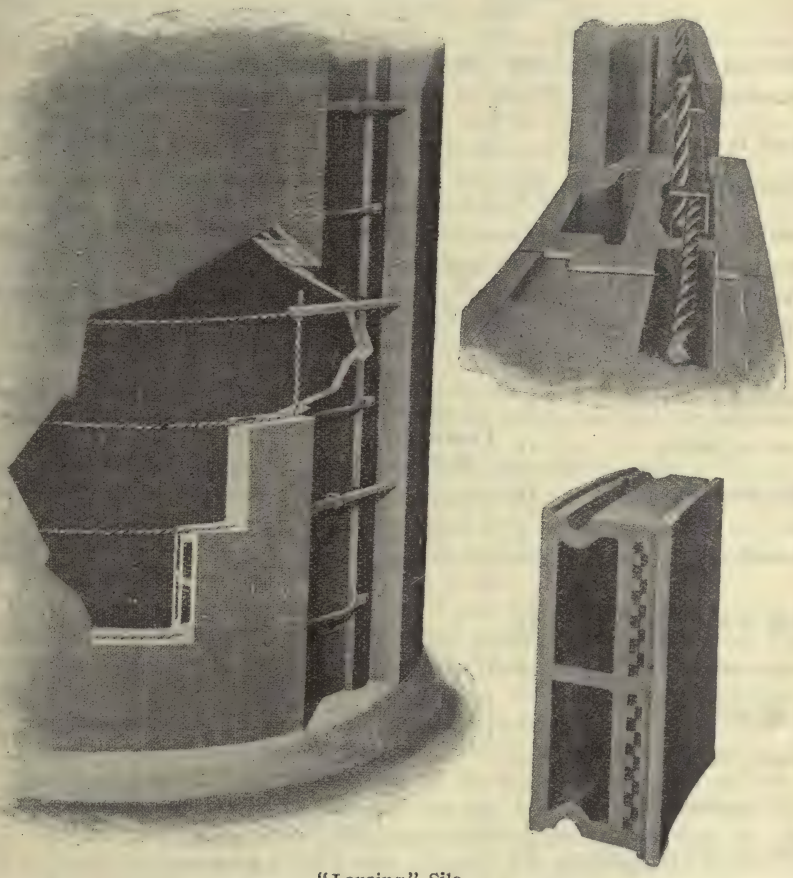
BUILDING CONSTRUCTION

333 – **The Lansing Silo.** — *Farm Implement News*, Vol. XXXVI, No. 48, pp. 33-43. Chicago, Illinois, December 2, 1915.

The Lansing silo, manufactured by the G. M. Preston Co. of Lansing Mich., is built of vitrified tile, one of the most durable substances in existence. Apart from the durability, another feature which recommends it is the air space in the centre of the blocks which render it non conductive to heat. This type of silo can be strongly advised where the temperature falls very low with the chance of freezing the ensilage.

The accompanying illustrations give a good idea of the material.

Each block has a ship-lap joint which makes each block grip its neighbour. When this is reinforced by twisted steel rods embedded in concrete it makes a construction strong enough to withstand any pressure that could ever be developed from within.



"Lansing" Silo.

The Lansing silo has a continuous doorway and a ladder easy to climb. The doorway runs to the foundation. The doors are of California redwood and are mitred to fit perfectly against the tile in silos of different diameters.

## RURAL ECONOMICS.

334 - **Managing Alfalfa Pastures in Arizona.** — CLOTHIER Prof. R. W. in *The Country Gentleman*. Vol. LXXX, N. 48, pp. 1792. Philadelphia, 27 November 1915. RURAL ECONOMICS

In the report made by the writer for the U. S. Department of Agriculture Bureau of Farm Management, a farm near Yuma, Arizona, is mentioned

*Management of an Alfalfa Farm.*

| Date | Number of days pastured | Field *A* 18 acres | Field *B* 18 acres | Field *C* 40 acres | Field *D* 40 acres | Field *E*, 24 acres |
|---|---|---|---|---|---|---|
| March 15–April 6 | 22 | 67 cattle | 67 cattle | | | |
| March 23 | | | | | | 24 tons hay |
| April 15 | | | | | 40 tons hay | |
| April 24 | | | | 60 tons hay | | |
| May 18 | | | 27 tons hay | | | 36 tons hay |
| May 14–June 3 | 20 | 130 cattle | | | | |
| June 3–June 14 | 11 | | 130 cattle | | | |
| June 10 | | | | 50 tons hay | | |
| June 14–June 26 | 12 | | | 130 cattle | | |
| June 26–July 14 | 18 | | | | | 140 cattle 10 mules |
| July 14–July 25 | 11 | 140 cattle 18 mules | | | | |
| July 25–August 5 | 11 | | 140 cattle 18 mules | | | |
| August 3 | | | | | 10,000 lbs seed 50 tons hay | |
| Aug. 5–Aug. 19 | 14 | | | 140 cattle 22 mules | | |
| Aug. 19–Aug. 28 | 9 | | | | | 142 cattle 22 mules |
| Aug. 28–Sept. 3 | 7 | 142 cattle 22 mules | | | | |
| Sept. 3–Sept. 10 | 7 | | 142 cattle 22 mules | | | |
| Sept. 10–Sept. 22 | 12 | | | | 142 cattle 22 mules | |
| Sept. 22–Oct. 5 | 13 | | | 142 cattle 22 mules | | |
| Oct. 5–Oct. 18 | 13 | | | | | 142 cattle 32 mules |
| Oct. 18–Oct. 25 | 7 | 142 cattle 3 mules | | | | |
| Oct. 25–Nov. 1 | 7 | | 142 cattle 12 mules | | | |
| Nov. 1–Nov. 22 | 21 | | | | 138 cattle 16 mules | |
| Nov. 15–Dec. 3 | 18 | | | 120 cattle | | |
| Dec. 3–Dec. 22 | 18 | | | | | 115 cattle |
| Dec. 14 | | 10 tons hay | | | | |
| Dec. 15–Dec. 25 | 10 | | 136 cattle | | | |

where, on an irrigated area of 140 acres, alfalfa is grown for hay, for seed and pasturage, the live stock consisting of matured steers and mules.

The 140 acres of alfalfa are divided into five fields, two of eighteen acres, two of forty acres each, and one of 24 acres.

The animals are pastured turn and turn about. After a field has been pastured, it is watered and allowed to remain till another crop has matured.

By following this system these five fields were made to furnish 261 days of pasturage to 139 animal units and in addition they produced 247 tons of hay, 10,000 pounds of alfalfa seed, and 50 tons of alfalfa straw. The farm of 140 acres maintained the equivalent of 141 animal units for twelve months and produced a surplus of hay and seed which sold for $1860. The cases of bloat were greatly reduced, being only three head during the last twelve months. The yield of feed is much greater than by the system of continuous pasturing, and the soil is always in the best of tilth owing to the absence of stock from the fields when they are wet. The stand of alfalfa is maintained and there are no noxious weeds. The accompanying table gives the season's pasturing schedule for the five fields.

335 – **Relation of Investment to Farm Profits in the Dairy Farms of Wisconsin** — Otis D. B. in *Hoard's Dairyman*, Vol. L, N° 20, pp. 631 and 658. Fort Atkinson., Wisc., 10, 1915.

Statistical data, collected from the owners of 80 dairy farms in Wisconsin have given the following results : Distinguishing the farms according to size, the first group of 36 farms averaged 136 acres and had on the average a total investment of $18 500. The average profit on these farms, after all farm bills were paid, was $ 1261 a year.

The second group of 44 farms averaged 204 acres in size and these had an average investment of $ 33 200. The net profit on these farms was but $ 806 a year. The difference in investment in these two groups of farms is due, mainly, to more acres and to larger and more elaborate buildings. These comparisons showed that the too-large farm does not pay as well as the smaller and better managed place. Neither does it pay to build larger and better buldings than are required for necessary comfort and convenience. Financial records, secured from 390 farms with silos and 141 farms without silos, have shown the yearly net profit on the first to be $ 875 a farm, and on the second $ 535 a farm. The difference in favour of farms with silos is $340 a farm, which is enough to pay for a good silo once a year.

Distinguishing the first 80 dairy farms mentioned according to invested capital, a first group of 55 have an average of $3 515 invested in operating or working capital, or 15.5 per cent of the total capital. These farms made a profit of $418 a farm a year.

The second group of 25 farms had an average of $10 475 invested in operating capital, or 29.5 per cent of the total capital. These farms made a profit of $2 312 a farm a year.

The writer therefore believes that to obtain good results the working capital of a dairy farm in Wisconsin should not be less than 25 per cent of the total capital.

Distinguishing the 80 farms according to the quantity and quality of live stock, the results were as follows : Twenty-seven farms with grade bulls and grade cows, valued at $744 a farm, made a profit of $439 a farm a year. Twenty-eight farms with pure-bred bulls and grade cows valued at $1 350 a farm, made a profit of $398 a farm a year. Eleven farms with pure-bred bulls and both grade and pure-bred cows valued at $4 521 a farm, made a profit of $1 266 a farm a year. Finally, fourteen farms with pure bred bulls and pure-bred cows valued at $8 960 a farm, made a profit of $3 135 a farm a year.

With the exception of the second group, the net profit is therefore closely related to the capital invested in cows, and increases in proportion to the increase both in number and in value of the cows.

336 – **The Cultivation of Pistachios in Sicily.** — PICONE, A. in *Nuovi Annali di Agricoltura Siciliana*, Year IV, Part. 3, pp. 129-162. Palermo, September 1915.

One of the difficulties preventing the extension of the cultivation of pistachios in Sicily is their slowness of growth, requiring 15 years to come to maturity. Consequently, almonds and vines are preferred, though after *citrus* the pistachio in the most profitable tree.

The writer calculates the cost per acre planted with trees 4 to 5 years old at about £8. Considering the profit obtainable from suitable intercrops up to the 10th year, when the trees come into bearing, the cost of the plantation to this period should not exceed £16-£17.10 per acre, whilst an almond plantation would cost from £12 to £14 during the first 6 years and a vineyard would cost about £32 during the first 4 years.

Owing to the long life of a pistachio plantation (100 years and more) the annual expenses during the productive period fall to 8/- per acre whilst for a vineyard they reach £1.12s per acre.

The writer calculates as follows the outlay per acre for pistachios during the 20th year, the first year of real production :

| | £ | s. | d. |
|---|---|---|---|
| 1st hoeing in November 30 days at 8 d. | 1 | | — |
| 2nd » » February. 18 » » 8 d. | | 12 | — |
| 3rd » » May . . . 12 » » 8 d. | | 8 | — |
| Pruning . . . . . 10 » » 1/— | | 10 | — |
| Superintendence | | 19 | 3 |
| Handpicking, transport, drying | 3 | 4 | — |
| Interest on capital advanced at 3 per cent. | | 4 | — |
| Expenses of plantation, annual share | | 8 | — |
| Interest on land | | 12 | 10 |
| | £ 7 | 18 | 1 |

In round figures the annual expenses are about £8 per acre. The yield of 1 acre of pistachios containing 100 trees, assuming that only about 80 yield satisfactorily and that each plant gives an average of 2.2 gallons of fruit, is about 176 gallons, which at the average price of £5 per 22 gallons, is equivalent to a gross profit of £40 or a net profit of £32.

337 – **The Cost of Milk Production in the Counties of Kent and Surrey; Further Report** (1). — GARRAD, G. H. (Agricultural Organiser for the County of Kent) in *Fourth Report of the Cost of Food in the Production of Milk in the Counties of Kent and Surrey, South Eastern Agricultural College, Wye.* 95 pp., 25 tables. London, 1915

The present report deals in detail with the period from May 1st 1914 to May 1st 1915 and summarises the results of the past 3 years work on the investigation of the cost of milk production in the two counties named. The mass of information contained in the paper enables a close analysis to be made of the economics of milk production under the particular conditions.

In calculating the cost of feeding the same cost-of-production prices were taken as in previous years *i. e.* Hay 60/- per ton, Oat Straw 40/-, Barley Straw 25/-, White Turnips 8/- and Chat Potatoes 20/-. These figures are the mean of the estimates supplied by farmers. All purchased foods are charged at cost price and no deduction has been made for the manurial values of purchased food. Nor was any allowance made for attendance on the animals etc., only the value of the food fed being considered.

The value of pasture was calculated from the acreage grazed and the value or rent per acre, allowance being made for variation in the quality of the pasture above or below the average. Aftermath was valued at 15%-20 % of the rent per acre and calculation based on this figure and the average grazed. Soiling crops were charged to the cows at the estimated cost per acre for cultivation, manures, seed, cutting and carting, rent etc.

The year was divided into 2 periods of 26 weeks, from 1st November to 30th April, and 1st May to 30 October.

Tables I and II summarise some of the more important results :

The following recommendations are appended to the Report :

(1) The amount of Concentrated Foods supplied to the cows should always be measured out according to the milk yield of each individual.

(2) The cost of keeping each cow should be calculated or estimated, and all unprofitable cows eliminated from the herd as soon as possible.

(3) All the best cows should be put to a bull of good milking strain and the heifer calves reared. In this way the milk yield of the herd can be improved from year to year.

(4) No improvement can be expected unless the milk records of the bull's dam and granddam are considerably higher than the herd average.

(5) To supply the necessary information for carrying out the above recommendations the keeping of Milk Records is absolutely essential. Weighing the milk one day each week is sufficient as the total yields calculated from weekly weighings will not vary from the actual yield by more than two per cent.

(6) Where possible, join a Milk Recording Society. Properly checked milk records are the only ones that are of any value for sale purposes, and the visits of a recorder act as a judicious tonic in ensuring that the records are kept up-to-date.

(7) The services of the milk recorder will become just twice as valuable if he is employed to check the weights of the food as well as the milk at each of his visits, and to calculate out the cost and composition of the ration.

(1) See for previous report *B.* April 1914, No. 378, and for other articles on the cost of milk production: *B.* Feb. 1912, No. 399; *B.* April 1912, No. 706; *B.* Dec. 1913, No. 1386; *B.* Jan. 1914, No. 63. (*Ed.*).

TABLE I. — *Cost of Summer Feeding and Milk Production of an Average Cow (1st May to 30th October).*

| | 1912 (692 Cows) | 1913 (633 Cows) | 1914 (617 Cows) | Average of 3 Summers |
|---|---|---|---|---|
| Average Cost of Food per Day . . . . . | 5.86 *d.* | 5.45 *d.* | 8.16 *d.* | 6.49 *d.* |
| » Daily Yield in Gallons . . . . . | 2.22 | 2.30 | 2.16 | 2.23 |
| Cost of Food per Gallon of Milk . . . . . | 2.64 *d.* | 2.37 *d.* | 3.78 *d.* | 2.93 *d.* |

TABLE II. — *Cost of Winter Feeding and Milk Production of an Average Cow (1st November to 30th April).*

| | 1912-13 (412 Cows) | 1913-14 (632 Cows) | 1914-15 (619 Cows) | Average of 3 Winters |
|---|---|---|---|---|
| Average Cost of Food per Day . . . . . | 12.29 *d.* | 12.12 *d.* | 12.50 *d.* | 12.34 *d.* |
| » Daily Yield in Gallons . . . . . | 2.13 | 2.26 | 2.14 *d.* | 2.18 |
| Cost of Food per Gallon of Milk . . . . | 5.77 *d.* | 5.36 *d.* | 5.84 *d.* | 5.66 *d.* |

(8) For economical milk production, cows which will milk well on a normal ration are absolutely essential. High feeding will only to a limited extent increase the flow of milk and is always an expensive proceeding.

(9) Long Hay should always be fed in moderation and no wasteful feeding tolerated. There is every indication that the cost of milk production can be reduced by limiting the allowance of Hay, especially Long Hay, and replacing a proportion of it with Oat Straw.

(10) The feeding of large quantities of Roots (above 60 lbs) appears to be uneconomical.

(11) To produce cheap milk in the summer a large area of cheap grass is a very important factor, and a limited area of grass combined with heavy indoor feeding is not an economical substitute.

(12) Cheap milk production in the winter depends more on attention to the quantity and proportion of the various foods in the ration than on the purchase of any one particular cake or meal.

(13) A variety of foodstuffs is better than any single food. The cost of feeding should always be kept in mind and the price of the foods as well as their composition duly considered before purchase.

(14) Each farmer must judge for himself which foods he can utilise to the best advantage, what he should buy and what he should grow. The home-grown foods should be grown as cheaply as possible and in suitable quantities.

(15) No amount of scientific feeding will be successful unless both the farmer and his cowman take an intelligent interest in the welfare of their cows.

## AGRICULTURAL INDUSTRIES.



338 - **Food Value of Different Types of Bread.** — PUGLIESE, A. in *Natura*, Vol. VI, Part August-December, pp. 254-275. Milan, 1915.

The types of bread studied in these experiments initiated by the "Museo Sociale dell'Umanitaria" at Milan were as follows:

A) *Normal type.* — Made with a 75 per cent flour in use before the Government imposed "Standard" bread.

B) *"Standard" bread imposed by Government.* — Made with 80 per cent flour used in experiments before the Government law was passed (1).

C) *Dark type with bran.* — Made from cleaned flour 85 per cent purity (2).

D) *Mixed type.* — Containing 82 parts of 80 per cent cleaned flour and 18 parts of maize flour.

The experiments were conducted with 6 workmen from the "Umanitaria" Workhouse and were medically certified as being healthy and vigorous. With regard to its nutritive qualities and heat value the ration selected was similar to that used in the previous inquiry by the "Umanitaria" on the food budget of the Milan working class family.

The energy value of the rations per day calculated in calories by Atwater's method was as follows:

| | | | | Calories |
|---|---|---|---|---|
| Albumen . . . | 109 gms | × 4 | = . . . . . | 436 |
| Fat . . . . . | 60 » | × 8.9 | = . . . . . | 534 |
| Carbohydrates. | 485 » | × 4 | = . . . . . | 1940 |
| Wine. . . . . | 400 cc. | × 0.6 | = . . . . . | 240 |
| | | | Total . . . | 3150 calories |

That of the bread was:

| | | | Per cent. of total |
|---|---|---|---|
| Albumen . . . | 49 gms | = . . . . . | 45 |
| Carbohydrates. | 303 » | = . . . . . | 62.24 |
| Dry Matter . . | 373 » | = . . . . . | 55.42 |
| Calories . . . | 1436 » | = . . . . . | 45.58 |

Taking into account the 170 gms. of pastry or rice fed each day the cereals provided:

60.09 per cent of the total albumen
88.45 » » » carbohydrates
80.23 » » » dry matter
63.93 » » » calories

(1) 80 per cent flour containing only the finest and almost invisible portion of the bran and yielding a white loaf. (*Ed.*).

(2) Bread made from cleaned flour of not less than 85 per cent purity, of a dark colour and only lacking the larger bran particles. (*Ed.*).

As in the case of the experiment with the workman's family the diet was characterised by a considerable predominance of albumen of vegetable origin and by a markedly small proportion of fat.

The experiment lasted 30 days and gave the following results :

From the first period (with 75 per cent bread) to the second period (dark type with bran) all the curves showed a rapid rise, then fell during the third period (75 per cent bread) rising again slightly during the fourth period (80 per cent bread) this rise being maintained with the mixed type of bread.

The most intense effects were observed with the dark type bread (C) in the second period, during which the quantity of faeces doubled, the same thing also occurred with the percentages of dry matter, water and albumen. Further, the effects of the bread containing bran continued until the first few days of the following period. Standard bread from 80 per cent flour (B) however, produced none of the effects of the dark type bread (C). It only showed a little more stimulating effect on the intestine than the finer flour of 75 per cent cleaning. The mixed type bread (D) was cheaper than bread made with 85 per cent flour, had a relatively higher food value and appeared preferable.

The effects of the dark type bread are due to the strong fermentative power of the bran, which accounts also for its therapeutic value, but also causes a considerable loss of nutritive matter. In the second period the percentage diminution in the absorption of the different nutritive substances was highest for albumen. The utilisation of the nutritive matter in the period with standard bread was a little less than that obtained in the preceding period with bread from 75 per cent flour.

According to the results the writer considers that household standard bread made with 80 per cent flour should be continued for the sake of national economy.

339 – **The Use of Pressed Apple Pomace.** — BARKER B. T. P. and GIMINGHAM C. T. (University of Bristol) in *The Journal of the Board of Agriculture*, Vol. XXII, No. 9, pp. 851-858. London, December 1915.

Pomace includes the product of both apples and pears after extraction of the juice in cider making. An official estimate places the yield of pressed pomace at 44 to 53 thousand tons, whilst the writer estimates it at 60 to 75 thousand tons. Its average composition is approximately : water 75 per cent., fat, etc. 1.2 per cent ; protein, 1.4 ; crude fibre 6.5 per cent ; ash 1.2 ; carbohydrates (sugar, etc.) 14 per cent.

The various uses of pomace are as follows :

*Feeding stuff*. It has a nutritive ratio of 1 : 16. It should be fed fresh and in moderate quantities mixed with other feeds. By storing under considerable pressure to keep out the air it forms a useful silage which keeps good for several months. Dried pomace is employed in making compound cakes and poultry foods, but the cost of drying is rather expensive.

*Manure*. Ordinary samples of pomace contain from 0.2 to 0.6 per cent of potash, 0.4 to 0.7 per cent of phosphoric acid, and 1.6 to 1.7 per cent of nitrogen, so that it is richer than farmyard manure. Its gradually

increasing acidity is an objection to its direct application unless lime or basic phosphate is added.

*Manufacture of Small Cider or Improving the Quality of Low-Grade Cider.* Small cider is made by extracting with water and may contain 3 to 4 per cent of sugar. Old or or "tainted" cider may be improved by re-soaking with the fresh pomace.

340 – **Utilisation of American Flax Straw in the Paper and Fibre Board Industry.** — MERILL JASON, L. in *U. S. Department of Agriculture Bureau of Plant Industry, Bulletin* N° 322, pp. 1-24 Washington, January 7, 1916.

The office of Paper-plant Investigations of the U. S. Department of Agriculture has published the results obtained with the use of flax straw in the paper and fibre-board industry. The cultivation of flax in the United States has increased considerably and now occupies an area of about 2 200 000 acres (1) producing 20 million bushels of seed valued at 33 millions dollars. The annual tonnage of straw amounts to 1.6 millions of which not more than 200 000 tons are at present put to any profitable use. The utilisation of the remaining 1.4 million tons would be of immense economic importance, since its paper producing possibilities are equal to the annual production of wrapping paper and more than double the annual production of writing paper in the United States. Its sale would represent an added revenue to the farmers of about $ 5 000 000 annually and would give this crop an assured place in national agriculture.

These experiments comprise the following scheme:

1) Preliminary laboratory experiments on the utilisation of flax straw as raw material for sack or wrapping paper manufacture, particularly studying the pulp obtained.

2) Paper wrapping tests on semi-commercial machines at Cumberland Mills, Me.

3) Mill tests on the manufacture of fibre board from flax straw on a semi-commercial scale in Maine.

4) Experiments on the preparation of flax tow from threshed straw at St. Paul, Minn.

5) Manufacture of fibre board from flax tow under commercial conditions in a counter-board mill in Maine.

Though the results of these experiments have not yet definitely solved the problem of the direct utilisation of flax straw as raw material in the manufacture of wrapping paper, they have shown that it may be used in the preparation of flax tow, to replace the imported tow from Europe (2) for the manufacture of counter-board.

The semi-commercial tests produced counter-board from the home grown flax tow of suitable quality for the consumers and at ordinary market prices. The tests have also shown that the domestic flax from Dakota can compete successfully against imported flax waste even though the manufacture is conducted as far east as Boston, and that if the manu-

(1) Average during quinquennium 1909-13.

(2) The United States imports about 7 000 tons of flax waste per annum for this purpose.

facture were localised near the flax region the results would be as 7 : 5 i favour of the domestic tow.

The writer suggests cooperative action amongst the farmers withi a 5 mile radius with a view to establishing their own tow mill and thu placing the new industry on a safe basis.

From present indications it appears that different grades of tow shoul be produced for the paper industry depending upon the grade of pape to be manufactured. Thus three grades of fineness of the tow could b established according to the amount of ligneous fibre removed.

At the present time there are 10 tow mills in the flax-zone, consumin from 1000 to 30 000 tons of flax straw per annum. The tow produced i used chiefly as material for upholstery and packing for crockery, glass ware etc., whilst a small quantity is made into insulating boards for refri gerator cars and also for rough twine.

The prices of baled flax tow at St. Paul, Minn. in September 1914 were Coarse $ 16; medium $ 18; fine $ 24; extra fine $ 32 per carload f. o. b. whilst the baled straw was selling at $ 7 per ton.

This tow is naturally a different product from that obtained as waste from flax mills.

The laboratory and commercial investigations will be continued along wrapping-paper and writing-paper lines in order to develop a market which will absorb an appreciable amount of this large and potentially valuable crop waste.

341 – **Strength Tests of Structural Timbers Treated by Commercial Wood Preserving Processes.** — BETTS, H. S. and NEWLIN J. A. in *U. S. Department of Agriculture Bulletin* No. 286, 15 pp. 7 diagrams, Washington, September 27, 1915.

This bulletin presents the results of tests made by the Forest Service of the U. S. Department of Agriculture, in cooperation with the Illinois Central Railway and some wood-preserving companies, to determine how the strength of bridge stringers is affected by commercial creosote treatments. To do this, comparison was made between the strength of treated and untreated stringers of the same size and quality. The woods tested were Loblolly pine, (*Pinus taeda*) Longleaf pine (*P. palustris*) and Douglas fir (*Pseudotsuga douglasi*).

The preservative treatments to which the timbers were subjected were as follows :

The physical properties of the timbers were determined before and after the treatments. The results were as follows :

*Loblolly pine.* Showed an evident weakening due to the treatment, probably not more than 17 per cent . The fibre strength at elastic limit and the stiffness both show a greater weakening due to treatment than does the breaking strength.

*Longleaf pine.* It does not appear that the breaking strength was affected by the treatment. There is a slight reduction in the average strength at elastic limit and stiffness.

*Douglas fir.* There appears to be a marked weakening of the breaking strength with the " boiling " process used. The average breaking strenght

| Treatment | Loblolly pine | Longleaf pine | Douglas fir |
|---|---|---|---|
| Steamed for | 4 hours | 6 hours | 4 1/2 hours |
| Under pressure of | 29 lbs. | 30 lbs. | 90 lbs. |
| Vacuum of | 26 inclus | 26 in. | 20 in. |
| Applied for | 1 hour | 1 hour | 18 1/2 hours |
| Cylinder filled with creosote and pressure | 125 lbs. | 128 lbs. | 0 to 140 lb. |
| Applied for | 4 1/2 hours | 5 1/2 hours | 2 1/4 hours |
| At a temperature of | 140° F. | 140° F. | 208° F. |
| Vacuum of | 23 1/2 in. | — | — |
| Applied for | 1/4 hour | — | — |

The Douglas fir was also boiled in creosote 21 3/4 hours at a temperature of 215° F; pressure raised from 0 to 145 lbs. in 5 3/4 hours.

of the stringers tested green and after seasoning is 33 per cent and 39 per cent, respectively, less than the average strength of the natural stringers. The fibre stress at elastic limit also appears to be reduced, although to a somewhat less extent. In the green material no weakening is apparent in the stiffness. The seasoned stringers, however, show a falling off in stiffness in the treated material.

With the "steaming" process the breaking strength and fibre stress at the elastic limit of green Douglas fir was considerably less in the treated material (35 and 36 per cent., respectively) and the stiffness was slightly less.

The conclusions arrived at are as follows :

1. Timber may be very materially weakened by preservative processes.

2. Creosote in itself does not appear to weaken timber.

3. A preservative process which will seriously injure one timber may have little or no effect on the strength of another.

4. The same treatment given to a timber of a particular species may have a different effect upon different pieces of that species depending upon the form of the timber used, its size, and its condition when treated.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

342 – **Method for Detecting the Admixture of Goat's Milk to the Milk of Cows.** — Brodrick-Pittard, N. A. in *Schweizerisches Zentralblatt für Milchwirtschaft*, Year 4, N° 52, pp. 413-414; Year 5, N° 1 pp. 3-4. Brougg, December 30 1915 and January 6, 1916.

Steinegger's method of determining the presence of goat's milk when used to adulterate cow's milk is based upon the fact that the casein of cow's milk dissolves readily in ammonia at a fairly low temperature (50° C) whereas the casein of goat's milk is insoluble in ammonia. Gabathuler and Pritzker have perfected the method by using apparatus like the lactobutrometer, or the albuminometer, in which the insoluble casein of goat's

milk was separated from the rest of the liquid by centrifugation. Subsequently, however, it was found that the same amount of goat's milk added to samples of milk from different cows, gave rise to different quantities of insoluble sediments. These variations have been attributed by GABATHULER to differences in the breed, individuality, and the lactation period of the cows, while STEINEGGER and PRITZKER consider them to be due to differences in the age of the goat's milk.

With a view to obtaining an explanation of these variations, several series of tests were carried out at the Berne-Liebefeld Swiss Dairy and Bacteriological Establishment in which were examined: *a*) the behaviour of the same goat's milk in the milk of different cows; *b*) the effect of colloids upon the flocculation of the casein of goat's milk; *c*) the effect of the colloid content of cow's milk on the formation of the sediment of insoluble casein; *d*) the effect of the age of the goat's milk upon the result of the test and, *e*) the part played by the substances used for preserving milk. The results, details of which are summarised by the writer in a series of tables, were as follows:

1) The same goat's milk, when mixed in equal quantities with samples of milk from different cows, produces variable quantities of sediment.

2) The amount of sediment formed in a mixture of goat's milk and colloidal solutions decreases with the decrease in the concentration of the solutions used.

3) The addition of distilled water to cow's milk, or the decrease of the colloidal concentration of cow's milk, diminishes the amount of sediment formed by the casein of the goat's milk.

4) When absolutely fresh goat's milk is added, the increase in the albumen content of the cow's milk causes an increase in the amount of the sediment of insoluble casein.

5) The amount of the insoluble casein deposited diminishes with the age of the goat's milk used.

6) Amongst the substances used for preserving milk, formalin has an unfavourable effect upon the formation of sediment, while bichromate of potash promotes its formation and brings about a very marked separation of the sediment from the serum.

7) The formation of the casein deposit is also promoted by a complete skimming of the mixed milk that is to be examined.

On the basis of these results, the writer recommends the following method for detecting the presence of goat's milk when mixed with cow's milk:

To the sample of milk to be examined are first added from 1 to 1.5 cc. of cold saturated solution of bichromate of potassium per 100 cc. of milk, and the milk is completely skimmed. 20 cc. of the skimmed milk are then placed in a SCHMID albuminometer, or in a GABATHULER tube, and 2 cc. of 20-25 per cent ammonia are added. The milk, after having been kept for 1 hour in the water-bath at a temperature of from 45-55° C., is again centrifugated at very high speed. The formation of sediment in the tube is a sure proof that the milk examined contains goat's milk. The writer is of opin-

ion that the presence of a minimum of 10 % of goat's milk can be determined with certainty, but the absence of sediment does not prove the entire absence of any goat's milk.

343 – **The Microscopic Analysis of Meat and Fish Meals.** — LUCKS, R. in *Fühlings Landwirtschaftliche Zeitung*, *Year* 64, Nos. 19-10, pp. 508-514. Stuttgart 1915.

Althought meat and fish meals have been used for some time past as cattle feeds, no exact method has yet been discovered for distinguishing them, or for determining their degree of purity. They are thus easily adulterated by the addition of either plant or animal matter. In the latter case, it is often a question of the addition of a bad quality of meat meal made from the carcasses of animals that have died of epizootic diseases. Meat meal thus adulterated can be a continual source of numerous cattle diseases.

The distinction of meat meals from fish meals can be based upon some of their constituents. The muscular tissue in meal made from the flesh of mammals is relatively very characteristic, but it is impossible to distinguish it from the muscular tissue in fish meal.

Fat, elastic and conjunctive tissue are of no use in diagnosis. When fresh, the blood corpuscles of different animals are very unlike, but in meals they are so much altered as to be unrecognisable. Hairs and scales are very characteristic and can be distinguished in meals, even if they are present in small quantities. As regards the bony particles, these, in the opinion of the writer, serve to distinguish the meals from one another. In all meat meal, except American, pieces of bone are present, sometimes even in large quantities. In the same way, fish bones are to be found in all fish meals. The difference between the structure of the bones of mammals and that of fish bones allows of the two kinds of meal being fairly easily distinguished from one another.

The microscopic method devised by the writer for this purpose is as follows :

Part of the meal to be analysed is well ground, the rest is kept as it is, and after some time the changes in it caused by keeping are studied. 5 gr. of the ground flour are placed in a porcelain dish and treated with chloroform. After ½ to 1 minute the results are observed ; if the meal contains mammal or fish bones, their débris forms a deposit at the bottom of the dish, while the muscular portions float on the surface of the liquid. These particles are decanted off with the chloroform, and the remainder is well washed in ether and subsequently examined under the microscope. The mammalian bones are easily distinguished from the fish bones, from the size of the lacunae separating the lamellae of the bones. These lacunae, though regularly present and well-developed in the bones of mammals, are often wanting or only slightly developed in those of fish. This character is absolutely reliable.

A second portion of the ground flour (5 gms.) is placed in a porcelain dish, then mixed and heated with 200 cc. of 50 % nitric acid. After heating, the meat meals assume a blackish-yellow colour, while fish meal

becomes a yellowish-brown, if made from herrings, and light yellow, if composed of cod.

A small portion of the meal treated with nitric acid is examined microscopically. As the acid has dissolved the lime of the bones, the latter cannot serve any more as a means of diagnosis. On the other hand, the muscular fibres are very characteristic. The rest of the meat treated with nitric acid is put in a porcelain dish and heated with about 200 cc. of 2 % lye of caustic soda. It is found that by this means nearly all the animal tissue present in the meal is destroyed, while the plant tissue is relatively well preserved. The whole is filtered, and the residuum on the filter is examined under the microscope ; if it consists of plants fibres, or pieces of wood etc., it may be concluded that the impurities in the meal come from the packing material. If there are also other impurities, pieces of straw, hay grains of oats, barley etc., bran, fragments of potato etc., it may be concluded that one is dealing with a meat meal made from carrion, the probability being that such carrion is derived from animals that have died of some contagious disease.

344 - **Bacteria in Fresh and Preserved Eggs.** — I. CALDWELL W. D. Bacterial Infection of Fresh Eggs. — II. MASON OBST M. Bacteria in Preserved Eggs. *Science*, N. S., Vol. XLII, No. 1079, pp. 322 and 320. Lancaster, Pa., 1915 (1).

I. — This paper presented the results of a bacteriological study of fresh eggs carried on at the Agricultural Experiment Station of the Rhode Island State College. The results are, briefly, as follows :

1. Of 2 510 fresh eggs from 65 hens, examined by the indirect method, 8.8 per cent. showed infection in the yolk.

2. None of 111 whites examined showed infection, while the yolks of the same eggs gave a percentage of infection (4.5) les than the average for the series (8.8).

3. The percentages of infection obtained for individual hens per year varied between 2.8 and 15.0, the average being 8.0 per cent. per year. No hen laid sterile eggs during a whole year.

4. No correlation was observed between the percentage of infection for any individual and the degree of fecundity of that individual.

5. Approximately the same amount of infection was found among fertile eggs (6.9 per cent. infected out of 422 eggs examined) as among infertile (3.9 per cent. infected out of 315 eggs).

6. The infection of eggs in the degree made apparent by the present studies seemed to have no unfavorable effect upon their hatchability.

7. Practically no difference between the percentages of infection of eggs from pullets and from hens in their second laying year was found.

8. No definite seasonal variation was observed in the bacterial content of the eggs examined.

9. No definite conclusion can be drawn from these studies regarding the influence of temperature upon the detection of infection in fresh eggs.

(1) See *B.* Feb. 1915, No. 224 and *B* July, No. 750. (*Ed.*).

10. From 57 infected eggs out of 737 examined in one of the series, 37 bacterial types were isolated, among which were seven cocci, eleven motile rods, eighteen non-motile rods and one spirillum.

11. Control plates exposed under the hood in which the examinations were made yielded a variety of organisms, largely chromogens. This series, as a whole, did not resemble the series of egg organisms.

Regarding the source of infection, this study indicated that the penetration of the shell after the egg had been laid, or infections during the passage of the egg through the cloaca, or during fertilization, or while the albumen or the shell were being deposited, are, to say the least, uncommon. It seems more likely that infection of fresh eggs is largely due to occasional chance infections with harmless organisms taking place within the ovary of the fowl.

II. — Commercial and strictly fresh June eggs packed in solutions of 1 : 5, 1 : 10, 1 : 20 parts commercial waterglass and in saturated lime solutions were stored in laboratory, barn cellar and at 34° F. Thermograph records were kept. Bacteriological and chemical examinations were made, also cooking experiments and parcel-post shipments.

Temperature of 80° F. in laboratory permitted rapid multiplication of bacteria in eggs. Barn temperature varied from 10° F. to 87° F. Eggs froze in solutions, later some thawed without breaking and at end of experiment showed no effects attributable to freezing. Bacterial content was uniform and fairly low. Bacterial increase in commercial eggs in 1 : 10 waterglass was rapid, especially in albumen, during first two months of storage. Eggs stored in cellar held a uniformly low bacterial content throughout experiment. At 34° F. eggs showed exceptionally low counts. Waterglass solutions contained practically no bacteria after five months of storage. Average bacterial content of eggs in nearly every lime solution increased more rapidly than in waterglass, necessitating the discarding of certain lime solutions early in experiment.

Curves were plotted showing increase of average bacterial content in relation to length of storage. Bacterial content of albumen in most cases remained lower or equal to that of yolks for 150 or 250 days of storage, then the former increased markedly and generally far exceeded that of the yolk.

From good eggs were isolated : *Micrococcus aurantiacus, Bacillus prodigiosus, Bacillus subtilis, Bacillus pyocyaneus, Bacillus fluorescens-liquefaciens, Bacterium termo, Bacillus zopfii.* One decomposed egg contained *Bacillus proteus* in large numbers.

345 – **New York State's Apple Auctions.** — *The Outlook*, pp. 166-167. New York, 22 September, 1915.

AGRICULTURAL PRODUCTS : PRESERVING, PACKING, TRANSPORT, TRADE

One of the most difficult problems for solution is the bringing together of the farmer and the consumer. A notable experiment in this direction is being made by the New York State Department of Food and Markets, under whose auspices a system has been begun whereby the apples of the fruit-growing districts of the State may be sold on the farm, by public auction. The farmers themselves requested and arranged for these auctions. In-

stead of a dozen men, each offering the produce of his own orchard, they grouped their holdings and offered twenty thousand barrels to the highest bidder. The buyers were invited to inspect the fruit as it hung on the trees and then came out with a fair open bid for what they thought it was worth.

The first sale of this character, held in Red Hook, New York, resulted in establishing a public wholesale price for apples, running from fifty to seventy-five cents a barrel above the prices established at private sales. It resulted also in bringing into the competition many buyers who had heretofore never come in contact with the farmer.

It is the ultimate hope of the Bureau of Food and Markets to establish in New York City a union freight terminal to receive and distribute food products. This terminal will contain, it is planned, auction rooms, display rooms, and ample facilities for the sale as well as the physical handling of farm products. This terminal would serve as a wholesale market-place from which both the grocer and the jobber who could best render the very necessary service of distribution could economically obtain his supplies. The plans of the Department also contemplate more efficient methods of assembling, grading, and packing food products at the producing centres.

This system of public auctions represents the application of no new principle. The bananas that arrive in New York City from the largest shippers and importers, almost all the California fruit, the two or three million dollars' worth of Almeria grapes which come from Spain every autumn, Sicilian lemons, and Florida oranges are all disposed of in this public and efficient manner. The interesting and vital factor in the case rests in the fact that the work is being undertaken by New York State for the benefit of its own farmers and its own consumers.

346 – **Regulations for the Commerce of Fruit in Cases, in Queensland.** — *Queensland Agricultural Journal*, Vol. IV, Part 5, pp. X-XI of Appendix. Brisbane, November 1915.

"The Fruit Cases Act of 1912" coming into force on the 1st June 1915, prescribes that all fruit sold in cases or exported to any place within the Commonwealth must be in cases of the dimensions mentioned below, which are the same as those required in New South Wales :

Bananas are excepted from the operations of the Queensland Act.

The regulations further prescribe that :

1) All cases for the Queensland trade must be new or clean and free from insect or fungus diseases.

2) New cases only must be used for fruit exported to any of the other Australian States.

3) New cases only must be used (under any circumstances) in the fruit districts of Stanthorpe and Bowen.

Every case, whether the fruit is for sale in Queensland or in another Australian State, must have legibly and durably on one end of the outside of the case :

*a*. The name and address of the packer of the case.

*b*. The words "guaranteed by packer to contain 1 Imperial bushel" or or as size of the case may warrant.

*Inside measurements of fruit cases clear of any divisions.*

| | Length — inches | Depth — inches | Width — inches |
|---|---|---|---|
| (1) 1 bushel | 18 | 14 1/4 | 8 2/3 |
| (2) do | 26 | 14 1/4 | 6 |
| (3) do | 20 | 10 | 11 1/8 |
| (4) 1/2 bushel | 18 | 7 1/8 | 8 2/3 |
| (5) do | 26 | 7 1/8 | 6 |
| (6) do | 18 | 5 1/4 | 11 3/4 |
| (7) 1/4 bushel | 13 3/4 | 4 | 10 1/8 |
| (8) Tropical Fruit Case (for Pineapples, etc.) | 24 3/4 | 12 | 12 |

In the case of the Tropical Fruit Case the guarantee should be — " guaranteed by maker to contain not less than 3 564 cubic inches ".

The above name, address and guarantee should be at least 5 inches long and 2 inches wide but stamps 3 inches by 1 1/2 inches and upwards will be accepted.

*Exception.* — The Act will not apply to the sale of fruit sold in trays, baskets, casks, or buckets, or to crates which contain trays of fruit. Fruit so packed, however, must have marked on the package the weight or number of its contents.

Penalties are provided for persons who :

1. Pack fruit for the Queensland trade in disease-affected cases.
2. Export fruit to another Australian State in second-hand cases.
3. Obstruct or refuse to give information to an Inspector who is carrying out the Act.
4. Place an incorrect guarantee on a case.
5. Export fruit in a case carrying an incorrect guarantee.
6. Alter the size of a case bearing the packer's name, address, and guarantee.
7. Interfere with the packer's name, address, or guarantee on the case.

347 - **Co-operative Poultry Marketing in Saskatchewan.** — *The Public Service Monthly of the Department of Agriculture*, Vol. IV, N. 5, p. 100. Regina, Sask., December 1915.

The Provincial Department of Agriculture of Saskatchewan, Canada, announces that a Poultry Killing and Marketing Station, under the joint direction of the Poultry Husbandry Section of the College of Agriculture, is to be operated in Saskatoon. Poultry producers in the territory tributary to Saskatoon are invited to ship their live birds to this station where experts from the Poultry Husbandry Department will supervise the killing, dressing, grading and packing of the birds. The Cooperative Organisation Branch will take delivery of the dressed birds and will forward advance payments to the producers at graded prices, consistent with the

quality of the birds. The poultry will be either sold immediately, or, should the prices be low at the time, placed in storage, until a satisfactory price can be obtained. When all the birds have been disposed of, a final payment will be sent to the producers which will return to them the price realized from the sale of their birds, less the actual cost of transportation, killing, boxes and storage charges.

Through this project the Department hope to be able to place on the market a considerable quantity of choice poultry, properly dressed, which will bring the producers a price considerably in advance of that received in recent years.

Throught the month of November the poultry marketing car stopped at points along the Canadian Northern Railway from Wadena to Rosetown. The number and quality of the birds delivered at the car has steadily increased; it comprised chickens, turkeys, ducks and geese.

# PLANT DISEASES

## DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

348 – **Growth Incompatibility of Oak and Olive Trees.** — PETRI L. in *Atti della Reale Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali.* Vol. XXIV, Series 5, Part. 11, pp. 536-539, 1 fig. Rome, 1915.

It has been common knowledge for some time past that olive trees are generally stunted in their growth when in the vicinity of oak woods. This fact may be explained either as the consequence of an excessive impoverishment of the soil, or as a kind of antagonism that may eventually occur between the roots of the two species of plants. Starting from the latter supposition, the writer has carried out a series of pot-cultures in which young olive and oak plants were grown together at intervals of 10 cms. Careful examination of the one year old oak roots grown in contact with the olive roots has shown the existence of small brown zones in correspondence with which the primary cortex, in process of being shed owing to the formation of the periderm, is seen to be in an advanced state of decay. Under the microscope these brown zones show occasional lobed vesicles of irregular oval shape originating from the extremities of thick mycelial filaments. The formation of these vesicles takes place in the deep strata of the cortical parenchyma.

The characters of the mycelium and of the vesicles correspond exactly to those of the mycelium and vesicles found in the endotrophic mycorhizae of the olive. The penetration into the one year old oak roots undoubtedly takes place shortly before the formation of the periderm. It is therefore merely a weak parasitism occurring on a dying tissue.

It is interesting to note that the one year old olive roots show no trace whatever of the infection, which leads to the conclusion that the olive roots are, at a certain distance from the apex, less receptive of this organism than the oak roots. The ectotrophical mycelium of these latter has apparently no parasitical action on the olive.

It may therefore be concluded that the failure of the olive trees often observed in the neighbourhood of oak woods is probably caused by the oaks having impoverished the soil, or by the eventual decay of the root due to the development of *Dematophora* in the soil remains. The theory of any injurious action due to the mycelium of the diseased oak roots may be totally discarded.

## DISEASES DUE TO BACTERIA, FUNGI AND OTHER LOWER PLANTS.

GENERALITIES

349 – **Contribution to the Mycological Flora of the Tyrol** (1). — Bubák Fr. and Kabat, F. E. in *Annales Mycologici*, Vol. XIII, N. 2, pp. 107-114. Berlin, 1915.

A list containing a large number of fungi observed in the Tyrol, some of which are new to science. Amongst others the following may be noted: 1) *Phyllosticta translucens* Bubák et Kabát n. sp., on living leaves of *Salix nigricans* (?); 2) *Aschochyta Juglandis* Boltsh., on living leaves of *Juglans regia*; 3) *Septoria Digitalis* Pass., on living leaves of *Digitalis lutea*; 4) *Septoria fuscomaculans* Kábat et Bubák n. sp., on living leaves of *Aconitum paniculatum*; 5) *Melasmia Lonicerae* Jaczewski, hitherto found only in Asia; the fungus collected in the Tyrol, which is perfectly identical with the Asiatic one, develops on the living leaves of *Lonicera coerulea*; 6) *Colletotrichum exiguum* Penz. et Sacc., on living leaves of *Spiraea Aruncus*; the spots, which are very numerous on the margins, are small, round and either light or dark brown in colour, edged with purple-brown. It is considered to be possibly a form of the same *Colletotrichum* already known in Italy; 7) *Ovularia pulchella* Sacc., on living leaves of *Triticum repens*; 8) *Ramularia Epilobii-rosei* Lindau, on living leaves of *Epilobium roseum*; 9) *Cladosporium myrticolum* Bubák n. sp., on leaves of *Myrtus communis*; 10) *Cercospora avicularis* Went., on living leaves of *Polygonum dumetorum*.

350 – **Dimorphism in *Coniothyrium pirinum* Sheldon.** — Crabill C. H., in *American Journal of Botany*, Vol II, No. 9, pp. 449-467. Figs. 1-15. Lancaster, Pa, November 1915.

The writer has often observed that *Coniothyrium pirinum* Sheldon, is sometimes dimorphic in culture and is probably so also in nature. Two distinct strains have been isolated, a plus strain which fruits abundantly, and a minus strain, which fruits poorly.

The minus strain arises in artificial culture by sudden sporting from the plus strain. This phenomenon has been observed in four separate instances. Minus strains never give rise to plus strains but remain constant generation after generation.

Attempts to develop the strain from each other by continuous selection of extremes have been unsuccessful. Attempts to determine the cause of the sporting have been fruitless.

(1) See also *B.* August, 1914, N. 788, and *B.* March 1915, N. 324. (*Ed.*)

The plus and minus strains of *Coniothyrium pirinum* have been used to inoculate apple leaves. In two weeks the spots inoculated with each strain turned whitish and bore several pycnidia from which it was easy to re-isolate the strain. The culture show that both the strains retained their diagnostic characteristics. One month after inoculation no enlargement of the seared spots had taken place. In fact some of the dead tissue bearing pycnidia of the fungus had fallen out, producing a "shot hole" effect. This is further evidence that *Coniothyrium pirinum* is a saprophyte.

351 – **The Persistence of Viable Pycnospores of the Chestnut Blight Fungus *(Endothia parasitica)* on Normal Bark below Lesions.** — STUDHALTER A. R. and HEALD F. D. in *American Journal of Botany*, Vol. II, No. 4, pp. 162-168. Lancaster, Pa., 1915.

The writers have studied the part played by birds and insects in the dissemination of the chestnut blight fungus, *Endothia parasitica* (Murr.) And.; the results they obtained may be summarized as follows :

1) The rains wash down from the infected portions of the tree trunks a large number of the pycnospores, which lodge on healthy bark below lesions. The writers found viable pycnospores of the chestnut blight fungus on normal bark lesions in numbers amounting to 172,222 per sq. cm. of bark surface (1,111,176 per sq. inch). An abundance of viable pycnospores was obtained at as great a distance below a lesion as 70 cm., and it appears very likely that they could be obtained at much greater distances below cankers.

2) Large numbers of pycnospores can be obtained immediately after a rain, and may, within certain limits, remain viable for two weeks. It therefore seems probable, though it cannot as yet be positively asserted, that the number of pycnospores to resist desiccation is greater on the bark below lesions than under other conditions.

3) Birds, and especially migratory birds, are capable of carrying large numbers of viable pycnospores for considerable distances; and insects may be important agents in the local dissemination of blight. Pycnospores easily cling to the feathers and claws of birds perched on the branches or searching for food in the bark of the tree trunks. The largest numbers of spores were invariably obtained from bird's feathers and from the wings, feet and abdomen of insects, two to four days after a rain, which, as has already been seen, washes the pycnospores in large numbers from the infected portions down the tree trunks.

352 – **Seasonal Duration of Ascospore Expulsion of *Endothia parasitica* ("Chestnut Blight Fungus")** (1). — HEALD F. D. and STUDHALTER R. A. in *American Journal of Botany*, Vol. II, No. 9, pp. 429-448, Figs. 1-6. Lancaster, Pa., November 1915.

Expulsion of spores from the perithecia of *Endothia parasitica* (Murr.) And., or chestnut blight fungus, begins in the spring with the first warm rain, and increases to a maximum of activity as conditions become more favor-

(1) See also *B.* Nov. 1914, No. 1074. (*Ed.*)

able, to be followed by a decline in the autumn when lower temperatures pre vail, and ceases entirely during the cooler portions of the year, althougi there may be an abundant rainfall. During 1913, the period of expulsio extended from about the middle of March to the middle of November. Fo 1912-13 there were 19 rain periods during the autumn, winter and sprin with no expulsion of ascospores, and in 1913-14 there were 18 rains whic induced no expulsion of ascospores. During one third to one half of th year there is then no expulsion of ascospores, but during the remainder ther is an abundant expulsion with each rain of any consequence (0.10 inches an over) except in a few instances when the temperature drops below the mini mum. Perithecial pustules of the chestnut blight fungus show a remarkabl power of spore production. This power is not exhausted during the cours of a single season, and in many cases is as marked during the second sea son as during the first.

The writers believe that the results of their observations point alsc to the conclusion that pustules first producing mature perithecia ir the autumn may continue to be a source of spores during the two follow ing seasons of perithecial activity, the maximum of production occurrin during the season following their maturity, with a gradually diminishin production of spores during the next season.

This remarkable power of *Endothia* which is not in accordance with what is known regarding many other pyrenomycetous fungi whose period of perithecial activity is very short, is due to successive maturity of asci, to successive maturing of perithecia, and the successive maturing of stomata throughout the season.

353 - **Effect of the Destruction of the Barberry *(Berberis vulgaris)* on the Common "Rust" of Wheat (*Puccinia graminis*) in Denmark.** — Lind J. in *Tidsskrift for Planteavl*, Vol. XXII, Part. 5, pp. 729-780. Copenhagen, 1915.

With the law dated March 27th 1903, the Danish Government issued a series of regulations regarding the complete eradication of *Berberis vulgaris*, the well known intermediate host plant of *Puccinia graminis*.

The good results obtained up to the present wholly justify the above mentioned regulations which, at the time of issue, were a cause of so much controversy.

During the last ten years the results obtained have been :

1) The gradual disappearance, contemporaneously with that of *Berberis*, of the "rust" ("Sortrusten") caused by *P. graminis*;

2) The severe attacks of "rust" which before 1903 used to occur every two or three years throughout the whole country, have no longer occurred;

3) The slighter attacks occurring on barley, forage grasses, and in Jylland even on oats, have also almost entirely stopped;

4) In the few places where the plant has not been destroyed, the "rust" still causes damage to the barley crops.

Against the above results one has only to bear in mind the fact that before 1903, the damage caused by "rust" amounted to over £ 500 000.

An extensive bibliography is appended.

54 – **Observations on the "Dwarfing" of Barley and on the Specific Resistance of Certain Graminae to several Species of Uredinaceae and Ustilaginaceae.** — HENNING ERNST, in Sveriges Utsädeförenings Tidskrift, Year XXV, pp. 130-137. Stockholm, 1915. RESISTANT PLANTS

Investigations carried out at the Experimental Station of Ultuna, Sweden, led to the discovery of numerous cases of "dwarfing" of barley, especially in the types 01 254 and 01 257 where as high a proportion as 80 per cent of the crops may be affected.

In the affected plants the stalks do not grow higher than 50 or 60 cms. while the ears have an average length of 2-3 cms. The six rowed and early types of barley are more subject to "dwarfing" than the two rowed types.

The disease may have been caused principally by the severe drought which occurred that year in the month of June, but the nature of the soil may also have had some influence; this is certainly the case for oats, the dwarfed specimens of which are always found growing on sandy soil, while they do not occur on the plots where the earth is tenacious and clayey.

On July 12th 1913, *Puccinia glumarum* ("Gulrosten") was first observed in the experimental field of the Ultuna Station. The types of wheat with close compact ears such as "Renodlad Squarehead", "Extra Squarehead II", "Sol", were immune; "Pudel" and the hybrids "Pudel × Sammets", and also the "Weibulls Iduna' variety, were immune.

In positive cases the attack is limited to the leaves and very seldom affects the ears. Distinguishing four degrees of infection we have the following data for the different types of wheat examined:

| Type of Wheat | Degree of infection on the | | | Observations |
|---|---|---|---|---|
| | 14th July | 19th July | 2nd August | |
| "Ultuna Landt" | 1 | 1 | 4 | |
| "Sammets" | 2 | — | 4 | |
| "Latorp" | 2 | — | 4 | |
| "Hedensbergs" | 1 | 1 | 4 | |
| "Fiholm" | 1-2 | 2 | 4 | |
| "Törneryd" | 1 2 | 3 | 4 | |
| "Arnö" | 2 | 2 | 4 | |
| "Värmländsk Landt" | 1–2 | 2 | 3 | |
| "Värmländsk Landt" | 1 | 2 | 3 | |
| "Värmländsk Landt" ("brunt") | (1) | (1) | (1) | A few plants with a little *P. glumarum*. |
| "Värmländsk Landt" ("brunt") | 0 | 0 | 0 | |
| "Västernorrlands" | 1 | 1–2 | 2–3 | |

The entire or nearly entire immunity of the "Varmländsk Landt" ("brunt") dark ear variety, is worth noting.

*P. graminis* ("Swartrosten") in 1913 appeared in Ultuna : on wheat July 14th ; on barley, July 18th, and on oats, July 22nd. The barley was not much damaged ; but such was not the case with oats, save one variety from Bönsta (Sodermauland) which proved to be highly resistant.

*Ustilago nuda* ("Naket Kornsto") attacked the following types of barley : "Hännchen" 0110, 0157, 0403 ("Chevalier II") and 0412, without damaging other varieties.

*Ustilago Avenae* ("Hafreflygsot") was found especially on the "Roslag", "Zyri", "Borstlos Probstejr", "Guldregn" and "Leger" types.

*Ustilago Tritici* ("Hvetets flygsot") was noticed on a single specimen of "Ultuna Landt" wheat.

355 - **The Control of Cabbage Yellows (*Fusarium conglutinans* Wollenw.) through Disease Resistance.** — Jones L. R and Gilman J. C. in *Agricultural Experiment Station of the University of Wisconsin, Research Bulletin* 38, pp 1-70, Fig 1-23 Madison, Wisconsin, December, 1915

Cabbage-growing with the winter variety known as Hollander or Danish Ball Head has assumed considerable proportions in various parts of Wisconsin. One of the worst enemies of this plant is *Fusarium conglutinans* Wollenw., which invades the roots either in the seed bed or soon after transplanting and by killing them and working up through the stem so weakens the plant that it yellows, drops its lower leaves, stops growing, and gradually dies or fails to head.

This parasite, probably introduced on seed into south-eastern Wisconsin some fifteen or more years ago, has rapidly spread in that section and is continually invading new territory elsewhere, so that it seems destined to follow intensive cabbage culture wherever in the State the conditions favour. The disease is worst when a period of dry hot weather follows soon after transplanting, since a high soil temperature favours its development. Once introduced into the soil, it persists indefinitely, so that ordinary crop rotations are of little avail for its control. Various methods of treatment of seed, seedlings and soil, including the trial of possible disinfectants and fertilizers, were without any practical effect. The most careful precautions are not sufficient to preserve the plantations, for any contamination of seed bed or field with diseased cabbage refuse or with infected soil, blown, washed, or otherwise carried from a cabbage sick field, will disseminate the parasite in new places. The only practical method of control, therefore, seemed to lie in the possibility of securing disease resisting varieties of strains. The Volga and Houser varieties show the highest degree of resistance against yellows. Neither of these is, however, suited to commercial culture in Wisconsin. The standard winter varieties of the Hollander or Ball Head type are especially susceptible and the practical problem, therefore, became that of securing a Fusarium-resistant strain of this type. The method employed has been based on the observation that even in the worst diseased fields in the autumn there are occasional sound heads. These have been selected, seed raised from them, this grown in turn on the sickest soil available and those plants which remain sound again saved as mother-heads for seed growing. By repeated selection strains have been secured

of winter cabbage of the Hollander type which have proved in a high degree resistant against the Fusarium. In 1914, the best selected head strain, VIIIa 25, gave a practically perfect stand, the heads averaging about 5 ½ pounds each, with a total yield of over 18 tons per acre, on thoroughly cabbage-sick soil, whereas the best commercial strain immediately alongside it showed over 80 per cent of yellows, the heads averaging about 2 ½ pounds each, and yielding about 2 tons per acre.

The second generation selections grown in this way have proved even more highly resistant than the first. Thus the first generation of the selected head strain VIIIa showed at the end of the season of 1912, 96 per cent living and 80 per cent headed, whereas the second generation seed from the heads selected from this crop in 1914, under a more severe test, averaged about 99 per cent living and 94 per cent headed, and the best of this series of head strains showed in turn 100 per cent living and 98 per cent headed. It is believed, therefore, that the degree of disease resistance, can, by further selection, be at least maintained and probably somewhat increased.

Seed is being grown from some 2000 heads of these selected head strains in 1915, which will permit distribution for planting on a commercial scale in 1916. This will be distributed under the name Wisconsin Hollander No. 8.

356 – **Varietal Resistance of Plums to Brown-Rot *(Sclerotinia cinerea)*.** — VALLEAU W. D. in *Journal of Agricultural Research*, Vol. V, No. 9, pp. 365-395, Pl. XXVII-XXIX. Washington, D. C., 1915.

In the control of plant parasites a great deal of attention has recently been paid to the possibilities of producing resistant plants by breeding. In the plum-breeding plots of the Minnesota Fruit-breeding Station at Excelsior it is very noticeable that the fruit of certain seedling varieties of plums (*Prunus* spp.) appears to rot much more readily than that of others. The rot is due to the attacks of the brown-rot fungus, *Sclerotinia cinerea* (Bon.) Wor. On the strength of these facts the writer has carried out a series of researches on the resistance of plums to the brown-rot fungus.

The following varieties were used for these experiments :

1) « B × W » = *P. triflora* (Burbank) × *P. americana mollis* (Wolf). The Burbank is a medium thick-skinned variety which becomes soft when ripe and is rather susceptible to the brown rot. Wold has a thick, tough skin and is not affected to any great extent by the rot in the field ;

2) « A × W » = *P. triflora* (Abundance) × *P. americana mollis* Wolf : Abundance is less subject to the attacks of the brown-rot than Burbank ;

3) « Etopa » × *P. besseyi* (Sand cherry) × *P. triflora* (Sultan) and « Wakapa » = *P. triflora* (Red June) × *P. americana* (De Sota) : thin skinned varieties susceptible to rot ;

4) « S. D. Nos. 1, 2 and 3 » all appear to be sand cherry hybrids ; « S. D. No. 1 » is a thin skinned variety and rotted badly on the trees when sprayed once with Bordeaux mixture ; « S. D. Nos. 2 and 3 » were thicker skinned, firm varieties and did not rot after one spraying ;

5) « Compass » = *P. besseyi* × *P. americana* (Hansen), is a thin

skinned variety which becomes soft on ripening and is susceptible to the brown-rot ;

6) « Reagan » = *P. hortulana* (Wayland) × *P. americana* (Hedrick) is thick-skinned, very firm when ripe, and is very resistant to the rot

7) « Hammer » = *P. hortulana mineri* × *P. americana* (Hedrick)

8) « Ocheeda » and « Harrison » are varieties of *P. americana ;*

9) « Manitoba N° 1 is probably a variety of *P. nigra.*

The brown rot fungus in Minnesota which produces the disease seems identical with that found in other parts of the United States and with *Sclerotinia cinerea* of Europe. Though the infection may take place through wounds and lesions of the skin, it may also at any time take place through the uninjured skin during the development of the plum fruit. Brown-rot is essentially a ripe-rot, affecting the plums most noticeably as soon as they begin to soften slightly as result of ripening. This, however, may be due to the circumstance that at the time of ripening the temperature is more elevated and therefore more favourable to the development of the disease. When the ripening takes place later towards the autumn and the temperature is lower, the presence of the brown-rot is less frequent. The writer has experimented by infecting the fruit with distilled water containing spores of *Sclerotinia,* or merely by contact with infected substance.

The rotting took with greater intensity and rapidity in the thin-skinned and tender-fleshed varieties. Thus the most susceptible varieties are : « Compass », « Etopa », « Wakapa », « Okiya », « Sand Cherry » (*P. besseyi*) and « S. D. No. 1 ». The thick-skinned firm-fleshed varieties : « Reagan », « Americana No. 1. », « B × W 15 », « S. D. Nos. 2 and 3 », are more resistant. Not only the degree of skin-thickness, but the presence of layers of corky cells, and the prodction of parenchymatous plugs which fill the stomatal cavity through which the hyphae are unable to pierce, have considerable influence on the penetration of the fungus. In the resistant varieties « B × W 15 » and « A × W 9 » the filling of the stomatal cavity is very common. That the complete plugging of the stomata is a factor in resistance is shown by the fact that many instances were noticed in which these stomata were covered by germinating spores with no resulting infection.

The hyphae of *Sclerotinia* did not produce a cellular-splitting enzyme which has the power of dissolving the cell walls, but they secrete a substance which splits out the middle lamella slightly in advance of their penetration through the tissue. Eventually the middle lamella is completely dissolved, and the cells in the rotted area being left entirely free from one another, die. The killing of the host cells seems due principally to a modification of the osmotic relations of the cells as a result of the disapearance of the middle lamella and to much of the liquid contents of the cells being withdrawn by the fungus to be used in its development.

The nature of the substance secreted is not at all clear. Attempts made to isolate the enzyme from a culture of the fungus were without success.

It appears to be almost certain that the chemical composition of the middle lamella varies a good deal in the different varieties of fruit; this would explain the different degree of resistance.

A great deal of attention is being given to the relation between chemical substances within the host cell and resistance. Cook and Taubenhaus were able to show that tannin, a very common product in plants, was toxic in varying degrees to many fungi. If, as is generally supposed, the tannins disappear on the ripening of the fruit, the greater susceptibility of some fruits to disease on ripening might thus be explained; but since the tannin does not come into direct contact with the fungus hyphae which are apparently always intercellular, the above hypothesis does not appear to be satisfactory. The doubt as to the relationship between gallotannic acid and resistance increases by reference to the following table in which the results of the determinations made by the writer are given:

| Variety | Condition | Date of ripening | Percentage of tannin in pulp | Percentage of tannin in dry matter | Percentage of dry matter | Relative susceptibility |
|---|---|---|---|---|---|---|
| Sand Cherry . . . | Ripe | Aug. 7 | 2.087 | 15.081 | 13.84 | + + + + |
| 131 × (Sand Cherry hybrid) . . . . | do | — | .234 | 1.483 | 15.75 | + + + + |
| Compass + Pin-cherry . . . . | do | — | .338 | 2.388 | 14.17 | + + + + |
| Sapa . . . . . | Turning | Aug. 17 | .362 | 3.367 | 10.75 | + + + + |
| Compass . . . . . | Green | Aug. 15 | .483 | 4.229 | 11.42 | + + + + |
| A × W12 . . . . | do | — | .482 | 3.418 | 14.10 | + + + |
| Opata . . . . . | Turning | Aug. 17 | .733 | 4.618 | 15.87 | + + + |
| Burbank . . . . . | Green | do | .185 | 1.516 | 12.20 | + + + |
| B × W21 . . . . | do | Aug. 19 | .773 | 5.777 | 13.38 | + + |
| A × W15 . . . . | do | Sept. 2 | 1.131 | 9.520 | 11.88 | + + |
| Americana seedling No. 1. | do | — | .665 | 3.873 | 17.17 | + |

The rot caused by *S. cinerea* is a firm-rot due to the mechanical support of the hyphae which completely fill the intercellular spaces left by the collapse of the host cell walls. *Penicillium expansum* produces a soft-rot, because of the fact that few hyphae are produced, and therefore, little mechanical support is given to the rotted tissue, which, as a consequence collapses as the rot proceeds.

DISEASES OF VARIOUS CROPS

357 - **Effect of Attacks by *Cercospora beticola* on the Composition of Sugar Beets** (1). — SAILLARD, EMILIE, in *Comptes-rendus des séances de l'Académie des Sciences*, Tome 162, N. 1, pp. 47-49. Paris, 3rd January 1916.

In 1915 the French sugar beet crop was attacked by *Cercospora beticola* Sacc. The damage was most serious in the districts of Oise, Seine-et-Oise, in parts of Seine-et-Marne, though the boundaries of the beet cultivated region also suffered, e. g. Seine-Inférieure, Eure, Loiret, etc. The harvest was bad both in quantity and quality, although the percentage in sugar was, with a few exceptions, more or less equal to that of an average year. Generally speaking, the juices were less pure and contained more salts ; the juices and alkaline sirups lost the greater part of their alkali in the process of heating for refinement and evaporation ; finally, from every cwt. of roots the quantity of sugar in bags obtained was less, and the quantity of molasses greater than usual. Similar anomalies were noticed in the beets of 1911, an exceptionally dry year. The writer has investigated the cause in the 1915 crop by determining the sugar content, total nitrogen, albuminoids, amides, and ammonia compounds, noxious nitrogen per 100 parts of sugar and comparing the results with previous years. The following results were obtained :

1) The 1915 beets contained per 100 parts of sugar larger quantities of total nitrogen, amide nitrogen, ammonia compounds, and noxious nitrogen, than those of the previous years ; and larger quantities even than those of the exceptionally dry year 1911. Like those of that year they lost a great deal of their alkali and yielded a very high proportion of molasses.

2) The results of the determinations of sugar by hydrochloric inversion and by enzyme-inversion are in agreement, but inferior (as much as 0.4 %) to those obtained by water digestion. There existed, therefore, in these roots dextro-rotatory substances differing from saccharose, that could not be precipitated by means of lead acetate.

The writer has found that these polarising substances disappeared for the greater part (as active substances) during the industrial manipulation, so that in the molasses practically no amide or ammoniacal nitrogen remains. The disappearance of these dextro-rotatory substances is therefore correlated to the elimination of the amide and ammoniacal nitrogen and constitutes a loss of polarisation. On the other hand, separate tests have shown that the aspartic acid and the glutanic acid heated in an alkaline mixture gradually lose their rotatory power and liberate ammonia.

358 - **Club-root *(Plasmodiophora brassicae)* in New Zealand.** — COCKAYNE A. R. in *The Journal of Agriculture*, Vol. XI, No. 3, pp. 197-203, Fig. 13, Wellington, 1915.

During 1915 club-root has been extremely prevalent in various parts of New Zealand.

Club-root attacks only plants belonging to the turnip family (*Cruciferae*) and in New Zealand has been reported as occurring on the following cultivated members of the group : cabbage, cauliflower, Brussels sprouts, rape, mustard, swede, turnip, soft turnip, radish, and wallflower. The

(1) See *B.* Nov. 1915, N. 1216. (*Ed.*)

disease is also found on the roots of certain weeds belonging to the same family amongst which may be especially mentioned : Shepherd's purse (*Capsella bursa-pastoris*), wild turnip (*Brassica campestris*), American cress (*Barbarea precox*), hedge-mustard (*Sisymbrium officinale*), and pepper-wort (*Lepidium niderale*).

Club-root is widely distributed, and has been found in all classes of soil in New Zealand. It is, however, most prevalent on the west coast of the North Island, and especially in the Taranaki and north Wellington districts. In the South Island it is comparatively rare as a field crop disease but is often abundant in garden soils. Those districts in which the underlying rock is largely composed of limestone generally are comparatively free from the disease, but at certain times bad outbreaks occur in such localities. In such cases it is probable that although the subsoil is largely of a calcareous nature the upper layers are deficient in lime, owing to it having been leached out in the ordinary processes of weathering. Acid soil conditions are far more favourable for the development of club-root than are those of neutral or alkaline soils. A very noticeable feature with regard to club-root is the fact that its prevalence as a serious disease did not take place in Europe until the modern use of fertilizers of an acid nature. The following are the most advisable means of control :

1) Abundant dressings of calcium carbonate (ground limestone) in the case of badly affected land, as much as 7 tons per acre, to be done in the autumn previous to the sowing of the seed.

2) Leguminous crops should be grown on affected land.

3) Preference should be given to the swede varieties which are more rsesistant, that is : Superlative, Magnum Bonum, John Bull, Elephant, and Crimson King.

359 - **Pathogenicity and Identity of *Sclerotinia libertiana* and *Scl. smilacina* on Ginseng *(Panax quinquefolia).*** — ROSENBAUM J. (Mycologist, Bureau of Plant Industry in *Journal of Agricultural Research* Vol. V, No. 7, pp. 291-297, Fig. 1, Pl. XXVIII-XXIX, Washington, D. C., 1915.

For a number of years two species of *Sclerotinia* (*Scl. libertiana* and *Scl. smilacina*) have been recognized as probable causes of the rotting of ginseng roots (*Panax quinquefolia*) but the pathogenicity and identity of these fungi have not been proved by inoculation experiments.

The writer has contributed a series of researches and experiments to the solution of this problem, the results of which may be summarised as follows 1) The species of *Sclerotinia* causing the white-rot of ginseng roots is identical with the *Sclerotinia libertiana* Fuckel occurring on lettuce, celery, and a number of other hosts. 2) The black-rot is due, on the contrary, to *Scl. smilacina* Durand, identical with *Scl. panacis* Rankin ; inoculations with a species of Sclerotinia from ginseng on *Smilacina racemosa* having given positive results.

360 - **Bamboo Smut Fungus (*Ustilago shiraiana* Henn) in Cuba.** — FAIRCHIL DANIEL in *Modern Cuba* (*Cuba Moderna*), Vol. 3 (7), No 11, pp 39-41. Havana, N vember 1915.

In the spring of 1910 one of the Japanese bamboos at the Chic Plant Introduction Garden was found to be attacked by a smut fungus indentified as *Ustiligo shiraiana* Henn. The disease has since been found t be spreading in other parts of the island, causing damages serious enoug to call for immediate attention.

The disease occurs first on the younger and growing portions of th branches, which appear somewhat swollen but show no external evidenc of smut. The growth of such diseased branches is arrested and, finally, a the external covering of the buds fall away, the sooty portions are exposed At a certain stage in the development of the disease a witch's brown forma tion is apparent. This disease is extremely serious and of the greatest econ omic importance as it may lead to the death of the entire bamboo forest

The wind is the principal factor in the distribution of the disease ; th branches of bamboo growing outside of the forest have been noticed to b much more than smutted the inner branches. The disease occurs o *Phyllostachys puberula* Munro, and *P. bambusoides* Sieb. and Zucc. in Cuba and on *Sasa ramosa* Makino and Shibata, and *Arundinaria simoni chino* Makino and Shibata, in Japan.

Burning of all diseased plants is the only sure means of eradication Spraying with Bordeaux mixture when the spring buds begin to develo has been suggested, but is a doubtful means of control.

361 - **Leaf-spot Disease of Lime (*Gloeosporium tiliaecolum*) in England** — SALMON E. S. and WORMALD H. in *The Gardener's Chronicle*, Vol. LVIII, No. 1500 pp. 193-194, Figs. 64-65. London, 1915.

*Gloeosporium tiliaecolum* Allescher was first noticed on the leaves of a large lime tree in a garden at Bearstead, near Maidstone, Kent. An account is given of the disease caused by this fungus according to Dr Laubert's observations in Germany.

## WEEDS AND PARASITIC FLOWERING PLANTS.

362 - **Comparative Researches on the Dimensions of the Seeds of Clover and Dodder.** — See No. 290 of this *Bulletin*.

363 - **Dandelion (*Taraxacum officinale*) in New Zealand** (1). — ATKINSON E. H. in *The Journal of Agriculture*, Vol. XI, No. 4, pp. 315-318, Figs 1-4. Wellington, 20th October 1915.

The writer, continuing the enumeration of weeds in New Zealand, gives a general description of the dandelion (*Taraxacum officinale*).

This seed is widely distibuted in both Islands of New Zealand, and is particularly common on roadsides and such waste places, and is also

(1) See *B.* Dec. 1915, No. 1352. (*Ed*).

abundant amongst grass, even when the latter is tall enough to cover the leaves over.

The achenes of dandelion are occasionally found as impurities in some agricultural seeds.

364 - **Californian Thistle Rust (*Puccinia suaveolens*) as a Check on the Spread of Californian Thistle (*Cnicus arvensis*)** (1) COCKAYNE A. H. in *the Journal of Agriculture*, Vol. XI, No. 4, pp. 300-302. Wellington, 1915.

For some years past it has been noticed that the Californian thistle-rust (*Puccinia suaveolens*) has increased considerably amongst these thistles in many parts of New Zealand. Its effect in reducing the vigour and subsequent development of the weed has been quite marked.

For the rust to become an adequate means of control it is necessary to increase infection considerably beyond that occurring naturally. In nature the attack is generally limited to a few shoots, and the plant may regain its vigour and develop normally.

A series of experiments has been carried out to discover a practical method for securing a rapid and complete infection. The result has been to establish that only the teleutospores produce a permanent type of mycelium, while the mycelium produced by the uredospores is temporary.

Teleutospores are therefore the best means for artificial infection.

Positive results were obtained by the following method : a quantity of diseased shoots in which the uredopustules are emitting spores should be soaked in water for about half an hour and the material constantly agitated so as to release the spores into the water. The water containing the spores should then be sprayed on young healthy thistles. After about fifteen days the small brown second-generation uredopustules will have commenced to develop. In the autumn, just before the leaves begin to wither away, the development of teleutospores will have been about completed, and the affected leaves should be collected, dried and kept till the early spring. The leaves should then be crushed up and soaked in water in order to liberate the spores, after which the water containing the spores should be sprayed on to the young growth of the thistles; in this manner the infection will be virulent and will spread rapidly.

365 - **Queensland Government Enquiry into Means of Controlling Prickly-Pear.** — JOHNSTON HARVEY T. and TRYON HENRY in *Report of the Prickly Pear Travelling Commission*, November 1, 1912; April 30, 1914, 131 pp. 66 Figs. Brisbane, 1914.

In September 1912 the Government of Queensland appointed a Commission to visit countries in which prickly-pears are indigenous or have become naturalised, for the purpose of ascertaining: 1) If there are in such countries any natural enemies of the prickly pear that may be utilised for the destruction of the plant in Queensland ; 2) The possibility of utilising prickly pear for commercial purposes.

Investigations were made in the following countries. Queensland, New South Wales, Java, Singapore, Malay States, Penang, Ceylon, In-

(1) See *B.* March 1914, No. 286. (*Ed.*).

dia, East coast of Africa, South Africa, Canary Islands, Europe and th Mediterranean area (England, Germany, Italy, Spain, Barbary State Malta, Syria), United States of America, Mexico, Central America, Wes Indies, South America (Colombia, Brazil, Argentina, Chili), Hawaiia Islands.

The results of the investigations are given separately for each countr visited. The following is a summary of the principal facts.

The prickly-pears naturalised in Queensland are: the common pes pears *Opuntia inermis* D. C., var.; the spiny pest pear *O. dillenii*, an ally o that just named; *O. monacantha* Haw., *O. aurantiaca* Gillies; *O. tomen tosa* S. D.; *Nopalea cochinelifera*, Linn.; *O. imbricata* Haw.; *Opuntia* sp.; (? *O. megacantha* S. D. or *O. chavena*, Griff. and another species, not identi fied, called the "yellow fruiting Mexican pear"; *O. nigricans* and *Nopa lea dejecta*, S. D. — New South Wales possesses: *O. inermis* D. C., var. *O. nigricans*, Haw.; *O. monacantha* Haw.; *O. ficus indica*, *O. microdasys* Lehm *O. monacantha* occurs naturalised in Victoria and South Australia, and the spiny pest pear of Queensland is also reported from the latter State.

The species naturalised in several other countries visited are:

in Ceylon: *O. dillenii*; *O. monacantha*;
in India: *O. dillenii*; *O. nigricans*; *O. stricta*, *O. monocantha*;
in South Africa: a variety of *O. decumana*; *O. aurantiaca*; *O. monacantha* and several others;
in the Canary Islands: certain species are cultivated as host plants for the true cochineal insect *Coccus cacti*;
in the Mediterranean region: *O. ficus indica*; *O. amyclea*; *O. dillenii*; *O. insemis*; *O. nana*.

In the cactus regions of the United States and Mexico, there occur several species of so-called "wood-rats" belonging to the genus *Neotoma*, which at times cause great havoc to prickly-pear, utilising it as food to such an extent sometimes as to exterminate it in places. However, since they, as well as various other rodents, are not restricted in their dietary to cactaceous plants, the writers do not advise their introduction to Queensland.

In Ceylon, India and South Africa, *O. monacantha* is attacked by a wild cochineal insect, *Coccus indicus* which, in the two first named countries has caused the almost complete extermination of the host plant. This cochineal does not attack in India *O. dillenii* and *O. nigricans* nor, in Ceylon, *O. dillenii*.

In South Africa another wild cochineal insect (*Coccus confusus capensis*), attacks *O. monacantha*, causing serious havoc but not completely destroying the plant.

The most important insect enemies of cacti found in America belong to the orders of Coleoptera, Lepidoptera, Hemiptera and Diptera.

In regard to the Coleoptera the various species of the genus *Moineilema* are widely distributed in the drier parts of the United States and Mexico; those of the genus *Caenopaeus* in Southern California and the adjacent regions; whilst the genus *Gerstaeckeria* has only one species injurious to prickly-pear, *G. hubbardi*, in Florida. The adult of *Moneilema*

and of *Caenopaeus* is a large black wingless longicorn beetle, which feeds gregariously on the young segments of the host plant, while the larva is a large grub living in tunnels hollowed out by it in the stems and joints.

The lepidopterous enemies comprise a number of cactus moth borers belonging to the Phycitidae (N. and S. America and W. Indies) as well as certain others, such as *Mimorista* and *Marmara* (especially in N. America and W. Indies). The caterpillars belonging to the genus Melitara and Zophodia spp. live within the joints of the plant, and cause great destruction, partly on account of their eating out the tissues and partly on account of the rapidity with which the attacked segments become invaded by secondary organisms such as bacteria, fungi and scavenging flies. *Mimorista* occurs in Texas, in the West Indies, Brazil and Mexico, and causes a great destruction of young segments of prickly-pear. The tiny caterpillar of *Marmara* is a "leaf-miner" and causes little injury as a rule, though secondary invasions may be serious.

Amongst the Hemiptera are certain prickly-pear enemies, especially the various species of wild cochineal insects, and the members of the genera *Chelinidea* and *Narnia*. These all more or less injure the plants. In Ceylon, India, South Africa and Mexico they cause more serious injuries which may result in the death of the plant.

The chief Diptera which infest prickly-pear are certain gall midges belonging to the genera *Itonida* and *Asphondylia*. The former produces galls under the areoles, and these may become the seat of secondary infection. The species of *Asphondylia* which infest Opuntias, live during their larval stage within the fruit or the flower bud, and either destroy the seeds or else cause a proliferation.

After pointing out that the insects enumerated are far from being the total of the insects injurious to Opuntia, and that especially in Mexico and South America additional natural enemies quite as injurious may exist and be utilised, the writers recommend that, for the time being, the following insects be introduced into Queensland: *Moneilema* spp., *Caenopaeus palmeri*; *Gerstaeckeria hubbardi*; *Melitara* spp.; *Mimorista flavidissimalis*; *Chelinidea* spp., *Narnia* spp., the wild cochineal insects; *Itonida opuntiae* and *Asphondylia opuntiae*, from the United States; *Zophodia cactorum* and its ally, the "Mendoza moth borer", from the Argentine Republic.

Certain destructive wild cochineal insects have already been introduced into Queensland from Ceylon and South Africa. These have become established, and have maintained their character for destructiveness, at the Prickly-Pear Experimental Station, Dulacca. In their native country these insects are more or less controlled by predators and parasites, and therefore cannot exercise their full influence. It is consequently a matter of great importance that, before admission into Queensland, parasites should have been eliminated. A careful supervision is therefore necessary. This would involve the providing of a suitable insectary under the control of an entomological staff with experience in this kind of parasitological work, as well as in the technical

details of receiving, multiplying and distributing such insects, both at the moment of leaving their original home, and at their arrival in Queensland.

The insects recommended for being introduced into Queensland limit their destructive action to the Cactaceae; this statement is especially true as regards the cochineal insects and is based on recorded observations and experiences of upwards of a hundred years standing and extending to many different countries. There are, however, a good number of other Cactus insects which do not feed only on prickly-pear but attack other useful and cultivated plants. Amongst these may be mentioned the Fruit Fly *Ceratitis capitata*, Wied; the Mealy Bugs *Pseudococcus obscurus*, Essig.; *Rhizococcus multi-spinosus*, Kuhlg.; the Cuban Cactus Coccid *Palaeococcus* sp., the Plant Bug *Stylopidia picta*, Uhler; the blossom-injuring Beetle *Trichochrous texanus*, Le Conte; the Calandrid root-borers *Cactophagus*, spp.; the Cactus Aphis *A. gossypii*; the Cactus Red Spider *Tetranychus* sp., etc.

As regards maladies caused by parasitic agency, the writers judge only one disease to be of sufficient value to warrant its introduction into Queensland. This is the "anthracnose", "shot hole", or "black rot" malady, caused by a fungus *Gloeosporium lunatum* E. and E. Ordinarily this organism has but little effect on the plant, but under conditions such as obtain on warm moist days it causes a considerable and rapid destruction of young segments. In the Argentine Republic there is a very serious disease" "the white rot" caused by a fungus *Sclerotium* (or *Sclerotinia*) *opuntiarum*, Speg., which brings about the destruction of joints and stems of various cacti. As the habits of this parasite are not sufficiently known, the writers do not, for the present, recommend its introduction. There are other parasitic diseases known in the West Indies, United States, Mexico, and the Mediterranean region, but their effects are not of much importance in controlling the spread of prickly-pear.

As a means of destruction by overgrowth, it has been suggested that the introduction of a certain fodder grass from Brazil might be of service, as on account of its rapid growth it would probably choke the prickly-pear. In a northern portion of South America a rapidly growing climbing leguminous plant is used. The twining branches form a network enclosing the prickly-pear clump around which the seeds of the plant have been sown, and then the stems are cut. After the climber has become sufficiently dry, it is set alight and the prickly-pear becomes seriously scorched. A repetition would probably destroy the latter.

As regards destruction by chemical means, the writers have found no method superior to those already in vogue in Queensland.

As a control to the spread of Opuntia, utilisation might prove of importance. The writers point out that the fruit of certain species of prickly-pear is used as a human food in many parts of the world, but more especially in Mexico and the Mediterranean littoral. Though this method would not be of much value in compassing destruction of Opuntias in Australia,

hey suggest that an abundant source of nutritious food, availed of in other countries, may have been entirely lost sight of here.

In India, South Africa, the Mediterranean region, America, and also Australia, the stems and joints of prickly-pear are mostly used as fodder, mixed with rations of more concentrated foods. The utilisation of Opuntia is, however, as yet in a more or less experimental stage. The writers believe it possible to reduce the very extensive area occupied in Australia by prickly-pear by using it largely as fodder, especially as the joints and stems of Opuntia seem to augment the quantity of milk produced ; they advise, however, to cut the plants and take away the fruit so as to avoid dissemination by means of the seeds in the excreta of the cattle.

Prickly-pear has been used to considerable advantage as a soil fertiliser, especially in India. It enriches the soil with humus and potash. The fruit has been used for alcohol production in Italy and Spain, where the manufacture was a commercial success until the imposition of an excise rendered the concern unprofitable. The introduction of this industry in Australia would probably lower the cost of eradication.

Utilisation of the fibre as a raw material for the manufacture of paper or mill board has not as yet given any good results, according to the investigations carried out by experts and by the Imperial Institute, London, principally on account of the high cost of production. Further experiments might, however, be made in Queensland, where the fibre could be obtained without much cost in the process of clearing the land. It is suggested that the mucilage might serve as a glaze for cheap cotton stuffs. In India it has been used as an addition to white wash and to a kind of plaster, employed in the decoration of edifices, which is said to have a fine texture and to be capable of receiving a fine polish.

According to the writers, the entire plants of prickly-pear including the root system, might be an important source for the manufacture of oxalic acid, as they contain a large amount of oxalate of lime in a crystallised condition.

The colouring matter of the fruit may be extracted and used for colouring sweets, beverages and various foodstuffs.

366 - **Kainit as a Means of Destroying Weeds** (1). — Witte Hernfrid, in *Sveriges Utsädesförenings Tidskrift*, Year XXV, Part 4, pp. 189-191. Stockholm, 1915.

In his experiments for destroying weeds, the writer has made use of kainit, calcium cyanamide, a mixture of kainit and calcium cyanamide, and of sulphate of iron. In nearly all cases the sulphate of iron (20-25 % solution) and the calcium cyanamide have given results much inferior to those given by kainit. Only in the case of *Papaver* sp. calcium cyanamide is to be preferred. Sulphate of iron has no effect whatever on *Centaurea Cyanus*. The action of kainit is heightened by the addition of a certain quantity of calcium cyanamide. The weeds most susceptible to kainit are : *Sinapis arvensis, Raphanus Raphanistrum, Polygonum Convolvolus,*

(1) See *B.* Jan. 1915, N. 117. (*Ed.*)

*Anthemis arvensis, Veronica arvensis, Stellaria media, Urtica urens, Senecio vulgaris, Centaurea Cyanus.* The weeds more resistant to the action of kainit are : *Spergula arvensis, Sonchus,* and *Papaver Rhoeas.*

Kainit works directly by means of plasmolysis, absorbing the water from the cells with which it comes in contact and causing the gradual withering of the plant. In the application of kainit the rules to be followed are :

1) 1340 lbs. of powdered kainit per acre to be evenly distributed over the soil. If *Sinapis arvensis* and *Raphanus Raphanistrum* are very abundant, it will be best to apply first 1785 lbs. of kainit and immediately after 90 lbs. of calcium cyanamide.

2) The applications should be made when the weather is warm and dry and in the early morning when the plants are still wet with dew.

3) For winter wheat the applications should be made in February and March, for spring wheat at the time of sprouting.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

MEANS OF PREVENTION AND CONTROL

367 - ***Ooencyrtus pacificus*, a New Egg Parasite from Fiji.** — WATERSTON JAMES in *Bulletin of Entomological Research*, Vol. VI, Part. 3, pp. 307-310, 1 Fig. London, 1915.

The writer describes as a new species under the name of *Oencyrtus pacificus* a Hymenopter bred from the eggs of the Bean Bug (*Brachyplatys pacificus* Dall.), at Rarawai, Viti Levu.

368 - ***Chilocorus bipustulatus* and *Exochomus quadripustulatus*, Recently Introduced from Italy into California as Natural Control of Injurious Scale Insects.** — SMITH HARRY S. in *Monthly Bulletin of State Commission of Horticulture*, Vol. IV, No. 11, pp. 523-525, Fig. 105-107. Sacramento, California, 1915.

The genera Chilocorus and Exochomus are probably the most efficient of all ladybirds preying upon Coccidae.

The writer mentions the introduction of two species, *C. bipustulatus* (L.) and *E. quadripustulatus* (L.), from Italy into California during the summer of 1915.

*C. bipustulatus* inhabits the whole of Europe, and also occurs in northern Asia. In Italy its principal hosts are *Philippa oleae, Pollinia polleni, Aspidiotus betulae, Diaspis pentagona* etc. The female deposits its eggs under the shields of *Saissetia oleae* or of the *Diaspinae;* the larvae, which hatch in four to eight days, are extremely voracious, and during their brief period of existence are capable of devouring several thousand eggs of scale insects. Approximately seven hundred specimens of this species were colonized at Fair Oaks, Sacramento County, during the period from July 21st to September 17th. They were placed in an orchard consisting of lemon, orange and olive trees, the citrus being infested with *Coccus citricola* Campb. and the olives with *Saissetia oleae* Bern.

Approximately three hundred and fifty individuals of *E. quadripustulatus* were placed in the same orchard on September 17th. This species occurs throughout Europe.

369 - ***Paraleptomastix abnormis*, a New Chalcidoid Parasite of the Citrus Mealy Bug *Pseudococcus citri*, Introduced from Italy into California.** — SMITH HARRY S. in *The Monthy Bulletin of State Commission of Horticulture*, Vol. IV, No. 11, pp. 525-527, Fig. 108. Sacramento, California, 1915.

*Paraleptomastix abnormis* Girault, was introduced from Palermo into California during the summer of 1914, as control of *Pseudococcus citri*. It has been bred extensively in confinement and widely distributed in the following localities : Sierra Madre, Upland, Alhamhra, Monrovia, San Gabriel Valley, Fresno, Marysville, Riverside, San Diego County, Sweetwater Valley, San Francisco, San Mateo County, Santa Paula, and Sacramento. Small colonies were also furnished to the Florida Experiment Station at Gainesville, and to the Board of Agriculture and Forestry, Honolulu, Hawaii. The results of the field investigations were very gratifying, the parasites been found breeding under natural conditions in the field at Alhambra. The same may be said of San Diego where the parasite has shown itself resistant to hydrocyanic acid gas in its earlier stages of development. It has been also observed that where the Sicilian parasite is breeding and Coccinellid predators are also working, the predators will devour every particle of mealy bug, but always leave the individuals which are parasitized by the Sicilian parasite after the pupa is formed.

It is proposed to increase the distribution of these parasites very greatly.

370 - **Woodpeckers and their Relation to Forestry in the British Isles.** — COLLINGE WALTER E., in *The Journal of the Board of Agriculture*, Vol. XXII, No. 8, pp. 789-791. London, 1915.

Woodpeckers are without doubt the most useful birds for destroying insects injurious to forest timber.

Numerous observations made by the writer in the open fully confirm the following two facts : 1) Sound trees are seldom, if ever, attacked, and 2) Large numbers of insects are destroyed by woodpeckers.

There are three species of woodpeckers in the British Isles, viz., the Great Spotted Woodpecker, *Dendrocopus major* (Linn.) ; the Lesser Spotted Woodpecker, *Dendrocopus minor* (Linn.) ; and the Green Woodpecker, *Gecinus viridis* (Linn.). The latter is by far the commonest, and the majority of the observations have been made on this species. Examination of stomach contents shows that fully 75 per cent of the food consists of injurious insects, the principal species being : Osier Weevil (*Cryptorrhynchus lapathi*, Linn.); Pine Weevil (*Hylobius abietis*, Fabr.) ; Bark Bettle (various species of *Tomicus*) ; Pine Beetle (*Myelophilus piniperda*, Linn.) ; Ash Bark Beetle (*Hylesinus fraxini*, Pz.) ; Elm Bark Beetle (*Scolytus destructor*, Oliv.) ; Black Pine Beetle (*Hylastis ater*, Payk.) ; Small Poplar Longicorn (*Saperda populnea*, Linn.). Common Longicorn (*Rhagium bifasciatum*, Fabr.) ; Rhinoceros Beetle (*Sinodendron cylindricum*, Fabr.) ; and Shot-borer Beetle (*Xyleborus dispar*, F.).

The larvae of the Pine-shoot Tortrix Moth (*Retinia buoliana*, Schiff.); the Birch Clearwing Moth (*Sesia culiciformis*) ; and the Wood Leopard Moth (*Zeuzera aesculi*, Linn.) have also occurred.

Of the remaining 25 per cent. of food quite 20 per cent. consisted of ants, the further 5 per cent. being made up of 1 ladybird beetle, 2 spiders, and insect remains not identifiable.

371 – **The Effect of Various Dressings on Pruning Wounds of Fruit Trees.** — See N° 306 of this *Bulletin*.

INSECTS INJURIOUS TO VARIOUS CROPS

372 – **A New Thrips (*Diarthothrips coffeae*) Damaging Coffee in British East Africa.** — WILLIAMS C. B. in *Bulletin of Entomological Research*, Vol. VI, Part 3, pp. 269-272, Fig. 1. London, 1915.

The writer describes, under the name of *Diarthrothrips coffeae*, as a new genus and new species, a Thrips causing serious damage to the leaves of coffee in several districts of British East Africa.

373 – ***Phaedon cochleariae* and Other Insects Injurious to the Horse-radish (*Nasturtium Almoracia* = *Cochlearia Armoracia*), in Sweden.** — TULLGREN ALB. in *Meddelande* Nr. 113 *från Centralanstalten för försöksväsendet på Jordbruksområdet, Entomologiska Avdelningen* Nr. 22, pp. 1-15, Figs. 1-4. Stockholm, 1915.

In 1913 *Phaedon cochleariae* Fabr. " Senapsbaggen " caused serious damage to the plantations of horse-radish in the vicinity of Enköping. The larvae of this insect eat away the margin of the leaves, sometimes leaving nothing but the veins. The perfect insects, which generally gather on the under surface of the leaves, damage them in a similar manner.

The following plants, though in a lesser degree, are also attacked : *Brassica Napobrassica* L. and *B. Rapa* L., also many wild cruciferous species such as *Nasturtium officinale* R. Br. and the species of the genera *Sinapis* and *Cardamine, Cochlearia officinalis* etc.

The distribution of this insect in Sweden is not as yet completely known. Up to the present it has been reported, besides from Enköping, from Närike (1891-1892), Morby and Margretelund (1892). In other countries than Sweden, from Bohemia (1861), England (1880 and 1890) and Bavaria (1908). The following means of control are advised :

1) All leaves and vegetable residues on which the insect habitually hibernates to be gathered in the autumn and destroyed.

2) All weeds and bushes around the horse-radish plantations to be rooted up and destroyed.

3) As soon as the insect is seen at the beginning of summer, a generous treatment to be given of arsenate of copper, and lime (200 gms. of arsenate and 400 gms. of lime in one hectolitre of water) combined with gelatine (20 gms. per hl. of water) ; this operation to be repeated once or twice during the summer when the larvae of the second generation begin to appear.

4) Arsenate of copper to be replaced when possible with arsenate of lead (300-400 gms. of arsenate of lead in 1 hl. of water).

During the study of this species other insects have been discovered that live on the horse-radish damaging it to a minor extent : *Plutella maculipennis* Curt. ; *Pieris rapae* L. ; *Pionea forficalis* L. ; *Meligethes brassicae* Scop. ; *Phyllotreta nemorum* L. ; *Eurydema oleracea* L. and *Philaenus spumarius* L.

374 - **Eggs of an Insect of the Order *Odonata* Occurring on Pear-tree Branches.** — FULMEK, L. in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Part 2, Vol. 44, N. 24-25, pp. 702-707. Jena, 12th January 1916.

About April 15th, the Station for the protection of plants in Vienna received from Trent (Tyrol) a certain number of pear-tree branches, about the diameter of a pencil, the soft cortex of which showed a number of superficial nodosities due to the punctures of an insect. The longitudinal axis of the nodosities was perpendicular to that of the branches. The nodosity had almost always a central wound in which the eggs of an insect were deposited in varying numbers. The wound was the size of a pin's head and was often covered over by the epidermis. The number of eggs it contained varied from two to four and even more. The eggs were deposited in the superficial layers of the vegetable tissue to which they adhered closely.

The tissue showed no disease except just round the wound. The length of the eggs was between 1.43—1.53 mm. and the breadth between 0.35—0.40 mm., they were of a yellowish-white colour turning to dark-brown at the extremities.

The insects bred from these eggs have been identified as belonging to the order *Odonata*, suborder *Zygoptera*, of which the family of the *Agrionidae* is the best known. The writer believes that the insect in question belongs to the last mentioned family.

The importance of this insect as regards the pear-tree is not yet known, but as it deposits its eggs only in the superficial tissue of the epidermis, it is most probably not injurious to the tree; the wound produced by the puncture of the insect may, however, favour the entrance of certain fungoid diseases.

375 - **Cherry and Hawthorn Sawfly Leaf Miner (*Profenusa collaris* n. g. and n. sp.) Injurious to Cherry and Hawthorn in North America.** — PARROT P. J. and FULTON B. B. in *Journal of Agricultural Research* Vol. V, No. 12, pp. 519-528. Pl. 41. Washington, D. C., 1915.

In June 1910, a leaf miner attacking cherry (*Prunus* spp.) was reported at the Experiment Station Geneva, N. Y. Some specimens were forwarded by Dr. A. D. MAC GILLIVRAY, who reported that the insect represented a new species, the type of a new genus, and should be recorded as *Profenusa collaris*. The information was also given that it had been reared from the hawthorn (*Crataegus* spp.).

According to present knowledge, the host plants of the sawfly leaf miner are the cherry and the hawthorn. Of the cherries, it has so far largely confined its attacks to the English Morello variety. It is not commonly observed wth the Montmorency or Early Richmond, which indicate that its presence on these varieties is accidental and occurs when they are grown in proximity to the English Morello. The extreme partiality of the sawfly leaf miner to the foliage of certain hawthorns which are only remotely related to cherry and the susceptibility of one fruit while other fruits are apparently unattractive or resistant, are interesting facts. Around Geneva the sawfly leaf miner is most common in the foliage of an unidentified hawthorn belonging to the *Medioximae* group, and is especially des-

tructive to hawthorns of the *crus-galli* group and to *C. nitida, C. pruinosa, C. rotundifolia* and *C. geneseensis ;* the larvae devour all the pulpy tissue of the leaves, only the epidermis remaining, which dries up and falls. The species of hawthorn that are generally exempt from attacks of *Profenusa* are *C. pedicellata* and *C. punctata.*

As a cherry pest this insect is found about Geneva in western New York and about Germantown, while it does not occur in the intermediate localities although the cherry is extensively grown there.

As a pest of hawthorns the sawfly miner has a wider range of distribution. It is reported about Boston, Mass., and is common in the vicinity of New York City, Rochester, Ithaca, Geneva, and Skaneateles, all of which are located in the State of New York.

Amongst the natural enemies of *Profenusa* the most common is *Trichogramma minutum,* an egg parasite, which destroys about 50 per cent. of the sawfly leaf miner's eggs. Besides the foregoing parasite there has been reared an ichneumon which proved to be a new species and has been listed by Rohwer as *Pezoporus tenthredinarum.*

The following methods of control are advised :

1) Picking and burning the affected leaves ;

2) Fumigation with hydrocyanic-acid gas ;

3) Ploughing and cultivating the ground so as to break up the cells of hibernating larvae.

4) Destruction of uncultivated host plants, especially the hawthorns of the *C. crus galli* group.

5) Spraying of hawthorns with a solution of nicotine and soap.

376 - **Hazel Woods in the Province of Messina Invaded by Caterpillars.** — SAVASTANO L., in *R. Stazione Sperimentale di Agrumicoltura e Frutticoltura, Acireale, Bollettino* No. 19, pp. 1-15. Acireale, 1915.

In the spring of 1915 various communes of the provinces of Palermo, Catania and Messina, especially the latter, suffered from an extraordinary invasion by the larvae of an unidentified Lepidopter, commonly called « campa del nocciuolo ».

In the commune of S. Pietro Patti, one of the places that suffered most, these insects have been known to appear at intervals for the past century. They remain for a few years and then disappear. The fact that, in 1915, the hazel woods were subjected to a particularly severe attack may be due to the excessively damp and warm spring weather.

As soon as the hazel trees begin to bud they are attacked by the young caterpillars which devour all the young leaves. This occurs at S. Pietro about the end of April, in other places the date may vary according to the geographical position. When the caterpillars on a tree are so numerous that the foliage is insufficient to feed them, they proceed to devour the more tender branchlets and also the young fruit, thus completely destroying the crop. The young branches then wither up, and though the tree may regain a certain vigour it will only give a poor crop in the following year. Were these attacks to be repeated for several years in

succession, the woods would undoubtedly be ruined, in fact in some cases this has already happened.

As regards control the following facts are known :

1) The increased number of attacks is strictly due to the increased area covered by the woods.

These pests can no longer be disregarded as unimportant as besides causing the loss of the present year's crop, they will probably mean the failure of those of subsequent years also.

2) The only effective remedy is arsenate of lead (1 %) applied with the necessary precautions. This method, however, being rather costly it will be best to reserve it for extreme cases.

3) The best method of permanent control would be to convert the wild filbert woods into cultivated plantations; hoeing and working of the soil being especially unfavourable to the hibernation of many species of insects.

The necessary increase of cost will be amply compensated by the improvement both in quantity and quality of the produce.

377 - **The Citricola Scale (*Cocus citricola*) in California.** — QUAYLE J. in *College of Agriculture, Agricultural Experiment Station, Bulletin* No. 255, pp. 405-412, Figs. 1-7 University of California Press. Berkeley, 1915.

The citricola scale (*Coccus citricola* Campbell) is one of the most injurious scales on citrus trees in California. It has been commonly known as the "Longulus scale" and has also been called the "False soft brown scale" The writer has, however, thought it best to call it the "citricola scale" after its first specific name. This scale seriously impairs the vigour of the tree and consequently greatly reduces the fruit production. It has in some groves reduced the crop some 50 to 75 per cent. and more.

The citricola is now widely distributed in California and this would seem to indicate that its occurrence dates considerably further back than its first recorded appearance. It was first found in the vicinity of Claremont in 1909 and at about the same time near Niverside and in certain sections of San Bernardino County. It has been known in the citrus section of Tulare County for the past three or four years, although its occurrence in great numbers dates back but a year or two.

In the countries south of the Tehachapi the citricola scale is found in Los Angeles, Orange, Riverside, and San Bernardino. In San Benardino County infestations occur at Colton, Redlands, Highlands, Rialto, Etiwanda, Cucamonga, Upland, and Ontario. In Riverside County the infested areas are in the vicinity of the city of Riverside and at Highgrove. In Los Angeles County they are at Claremont, Pomona, San Dimas, and Glendora. In Orange County one infestation is found near Fullerton.

In the counties north of the Tehachapi the most general infestation occurs in Tulare County. The heaviest infestations occur around Porterville, Worth, Globe, Success, Lindsay Exeter and Orosi. In Fresno County the citricola scale occurs in the citrus districts of Mt. Campbell and near Sanger. In Sacramento County it occurs in the Fairoaks and Orangevale districts, and in Placer County at Rocklin. In Yuba and Sutter countries it has been reported from citrus trees growing in the cities of Marysville

and Yuba City. In Contra Costa County on one tree in Martinez. In Kern County on one tree near Bakersfield, but in these two last cases eradication treatment was given and the scale has not as yet reappeared.

The citricola scale, which is primarily a pest of citrus trees in California, has been found on a few other plants, but in all cases these plants were growing in the vicinity of infested citrus trees. These include nightshade, pomegranate, elm and walnut.

The young appear about the last week in April and continue to appear until August. During the summer, autumn and winter the scales remain almost exclusively on the leaves and grow very slowly. By November there is an appreciable change in size and colour. At this time also migration to the twigs begins. This migration from leaf to twigs continues slowly through the winter but the great majority migrate in March and early April. The scales remain more or less dormant until the warmer spring weather when they grow very rapidly and produce eggs before May 1st. The complete development of citricola requires approximately one year.

The most satisfactory treatment for the control of the citricola scale is fumigation with hydrocyanic acid gas between July 15 and September 15. Fumigation results are less certain later in the year. Where fumigation is not feasible, spraying with kerosene and kerosene emulsion should be adopted.

Among the natural enemies of citricola the following may be enumerated: *Coccophagus flavoscutellum, C. lunulatus, C. lecanii, Aphycus flavus* and *Chilocurus bivulnerus*. It is probable that some of the species of *Rhizobius* also feed on the citricola scale.

378 - ***Brassolis sophorae*, a Butterfly Injurious to Coconut Palms in British Guiana.** — CLEARE L. D. Jr. in *Bulletin of Entomological Research*, Vol. VI, Part 3, pp. 273-278, Fig.1 Pl. VIII-X. London, 1915.

During 1914 the coconut palms in the city of Georgetown have been rather severely attacked by the larvae of the Cocount Butterfly, *Brassolis sophorae* L.

The first appearance of *Brassolis sophorae* as a pest dates back many years. SCHOMBURG in his "Fauna und Flora von British Guiana" (1848) records it as being found on the coast-lands but gives no food-plant. In 1905 it has been reported from Plantation, near Clonbrook, where large areas of coconuts were considerably damaged. In 1909 it again appeared in the Mahaicony district. Between 1909 and the present attack *Brassolis* was of little importance and it would thus appear that it only occurs in such numbers as to cause considerable damage at intervals of about five years.

The attacks of this pest are not confined to the coconut palm. The common Cabbage Palm (*Oreodoxa oleracea*) is also attacked.

Little is known of the distribution of the coconut butterfly in British Guiana. It has been reported from Plantation Grove near Cloubrook, the Mahaicony district, and Georgetown in the county of Demerara; and from Onderneeming, on the Essequibo Coast.

Outside of the Colony, *Brassolis* was recorded from Dutch Guiana

by M^me^ Merian, as early as 1705, and while she gives *Müllera moniliformis* as the food-plant, adds that later she found a very large number on a high coconut tree.

KAYE mentions it in his Catalogue of *Lepidoptera Rhopolacera* of Trinidad, and gives the range as Guiana to South Brazil. The caterpillars devour all the green part of the leaves, leaving only the central midrib and the fine lateral veins. They pass in this manner from leaf to leaf until the entire tree becomes denuded. The attack may be so severe that the tree succumbs.

Fortunately this pest has many natural enemies. Many birds, particularly the common Kiskadee (*Pintangus sulphuratus*), feed on the adult insects, while both the eggs and pupae are parasitised. Two species of egg-parasites were also reared and are at present being determined. Recently the well known parasite *Chalcis anulata*, F., has been obtained from the pupa of this insect.

The habit of the larvae of living in "nests" during the daytime offers the best means of controlling this pest. The nests can be easily seen from the ground, and by cutting down the branches bearing them large numbers of larvae can be killed.

379 - **Mites Injurious to Various Wild and Cultivated Plants in Sweden.** — TRÄGÅRDH IVAR, in *Meddelande från Centralanstalten för försöksvänsendet på Jordbruksområdet, Entomologiska Avdelningen*, N. 20, pp. 1-50, Figs 1-20. Stockholm, 1915.

A description of various species of the genera *Neotetranychus*, *Paratetranychus*, and *Tetranychus* which in Sweden damage the following plants: cucumber, melon, bean, rose, vine, peach, palm and other hot-house and kitchen-garden varieties, apple, plum, lime, elm and poplar.

These mites fix their sharp pointed sucking organs into the leaf tissue and absorb the cell contents; discoloured patches appear on the margins of the leaves which spread and mingle until the leaf withers up and dies.

The genus *Tetranychus* is found almost exclusively in the southern districts. North of Upsala (60° lat. N.) it has been reported only three times, at Kopparberg once and at Härnosand twice.

*Paratetranychus pilosus* Can. et Fans. ("Fruktträdskvalstret"). — The winter eggs of this species, which are red in colour and spheroidal in shape, sometimes cluster on the apple branches in such numbers as to give the branches themselves a red colour. The eggs hatch early in May and during the summer four generations mature in succession. Warm weather is most favourable to their development. The plants attacked are: apple, plum, wild plum, and possibly also pear.

It has been reported at Lindesberg (district of Örebro), Alnarp, Upsala, Vinslöv (Krist. l.) Härnosand (Vasterlds. l.), Järläsa (district of Upsala), Hellby Brunn (district of Söderml.) etc.

*Paratetranychus ununguis* Jac. ("Barrträdskvalstret"). — This species has been seen in Sweden on: *Picea excelsa*, *P. alba*, *P. sitchensis*, and *P. Engelmanni*, and on the larch. Winter eggs are laid and in the warm season four generations mature.

*Neotetranychus rubi* n. sp. has been found only on *Rubus Idaeus*.

*Tetranychus althaeae* v. Hanst ("Växthusspinnkvalstret"). — This is the most widely spread and most injurious species; from early in May, all through June, July and August it causes serious damages to cucumbers, melons, beans, garden plants and kitchen-garden produce; it is believed to attack also peach, palm and vine. In Germany this mite was observed on *Althaea rosea, Lycium barbarum, Phaseolus multiflorus, Bryonia alba,* and *Humulus Lupulus.*

According to reports from various places: Stenby (Stockholm), Charlottenlund (Mallmöhus, Lenköping (Östergötl.), Geräsen (Örebro), Munsö and Tkerö (Stockholm), the development of the mites is the more rapid and the damage more serious and extensive, the hotter and drier the weather.

*Tetranychus telarius* L. ("Vannliga Spinnkvalstret"). — Attacks the lime, *Prunus Padus,* elm, maple and poplar. In Sweden it has been reported at Åkersta, Kristinehamn, Vadsbro, (Söderm.), etc.

It has been also found in North America, widely distributed from Ontario to Texas, and from British Columbia to California, in South Africa, the Hawaii Islands, and in Australia. With regard to means of control, the knowledge of the animals natural enemes is too limited to be counted upon, only one larva of *Coniopteryx* having been thus identified. The writer has made various experiments with fungicides with the following results:

1) Comparative trials with applications of carbon bisulphide, quassia and nicotine; the following table is for cucumbers:

| | Number of mites | | | |
|---|---|---|---|---|
| | alive per plant | dead | per leaf | decrease per cent. |
| Plants not treated . . . . | 552 | — | 18.4 | — |
| With carbon bisulphide . . | 31 | 366 | 1.0 | 94.6 |
| » quassia . . . . . | 78 | — | 2.6 | 85.9 |
| » nicotine . . . . . | 86 | — | 2.8 | 84.8 |

The above table shows that the number of mites per leaf which in the untreated plants average 18.4, decreases in those treated with carbon bisulphide to 1.0; with quassia, to 2.6; with nicotine, to 2.8.

2) Hot-house experiments against *T. althaeae* made with 125 gms. of carbon bisulphide in 5 litres of water mixed with gelatine and 200 gms. of quassia and nicotine. The plants used for test purposes were cucumbers; the results surpassed every expectation, all the mites and their eggs being killed.

380 – **Insects Injurious to Pine and Fir Trees in Sweden.** — TRÄGÅRD IVAR, in *Skogvårds Föreningens Tidskrift,* Year XIII, Part 11, pp. 813-874, Figs. 1-49. Stockholm, 1915.

A list of microlepidoptera injurious to pine and fir trees in Sweden:

*Pandemis ribeana* Hb., common in the central and southern provinces of Sweden as far as Uppland. The larvae of this lepidopter are polyphagous and attack *Crataegus, Rosa, Prunus, Pyrus, Quercus, Rhamnus, Fraxinus, Sorbus, Acer, Tilia, Betula, Ribes, Berberis,* and *Geum.* The writer has also noticed them in great numbers on the young pine trees of the For-

estry Station near Stockholm, of which they devour the leaves and the cortex of the young shoots.

*Dioryctria schützeella* Fuchs, injurious to pines; is similarly distributed to *Pandemis*.

*Grapholitha* (*Epiblema*) *tedella* El. ("Granbarrvecklaren") causes damage of little importance to the leaves only.

*Grapholitha* (*Epinotia*) *manana* Tr. ("Dvärgbarrvecklaren"), has been reported for the first time as injurious at Frostviken and Kvesiön, Norway, in 1913. Numerous pines in those places were partly despoiled of their foliage, but the young yearling shoots continued their normal development.

*Argyresthia illuminatella* Zell. ("Granknoppsmalen"), attacks the growing tops and young leaf buds of pine trees and after destroying these, penetrates into the branches, burrowing galleries in the region of the bast, thus causing various growth anomalies. It has been reported, up to now, from the province of Stockholm, in the northern parts of Jämtland and in the Malar islands.

*Cacoecia piceana* L. ("Tallvecklaren"), the larvae of which attack the leaves of fir trees, and conceal themselves, in order to hibernate, in tufts of three of four leaves which they cause to stick together, forming a sort of tube.

*Evetria resinella* L. ("Hartsgallvecklaren"), the larvae of which destroy not only the cortex of the young shoots but also attack the leaves nibbling them at their bases.

*Heringia dodecella* L. ("Tallskottmalen"), during the first stage the larvae remain on the fir leaves; later they destroy the buds causing very serious damage; they have been found at Skåne, Smålano and Gottland.

*Cedestis gysselinella* Dup. ("Större Tallbarrmalen"), is harmful to the leaves of firs.

*Dyscedestis farinatella* Zell. also attacks the leaves of firs.

*Ocnerostoma piniariella* Zell. ("Gråa Tallbarrmalen") attacks and gnaws fir tree leaves; is frequently found in Skåne, Småland, Gottland, and Uppland; the writer has also found it at Runmarö near Sandham, Nynäs and Karlsborg. In all these places the damages caused are very serious, and would be still more so were not the spread of *Ocnerostoma* actively controlled by its natural foe, *Ageniaspis fuscicollis* Dalm.

381 - **Insects Injurious to Timber in Sweden.** — KEMNER, N. A. in *Meddelande N.* 108 *fran Centralanstalten för Jordbruksområdet, Entomologiska Avdelningen*, N. 19, pp. 1-43, Figs 1-33. Stockholm, 1915.

The insects that are specially injurious to timber in Sweden belong to the family of *Anobiidae* ("Trägnagarna").

*Anobium striatum* Oliv. (*An. domesticum* Geoffr., *An. pertinax* Fabr., "Strimmiga trägnagaren") attacks *Abies* sp., *Betulineae*, *Fagus silvatica* and less often oaks and ash.

This insect is common in the southern and central districts of Sweden, and has recently been reported also from places situated beyond what was usually believed to be the northern limit of its distribution.

*An. pertinax* L. (*An. striatum* Fabr., "Envisa trägnagaren") is found

in the southern and central regions; it has also been reported in Lapland. Like the preceding species it attacks *Abies* and some Amentaceae, causing, however, but slight damage.

*Xestobium rufovillosum* D. G. (*X. tesselatum* F., *X. plusator* Schall., " Skäckiga trägnagaren ") attacks preferably oak trees but is also found on beech and on *Pinus silvestris* and *Tascus baccata.*

*Ernobius mollis* L. (" Mjuka trägnagaren ") is distributed all over Sweden. It burrows galleries between the bark and the wood, and when the former is very thin, may even penetrate to a depth of some centimetres into the wood.

*Ptilinus pectinicornis* L. (" Kamhornade trägnagaren ") is distributed all over Sweden where it damages not only standing trees but also cut wood. It attacks oak, beech, alders, maple, walnut, willow and other kinds as well.

Amongst the chief natural enemies of *Anobiidae* are : *Opilo domesticus* Sturm., *O. mollis* L., *Corynetes ceruleus* D. G. and *Tillus elongatus* L. (the special enemy of *Pt. pectinicornis*), which kill the perfect insects. There are also some Hymenoptera the larvae of which are parasitic on the larvae of *Anobiidae : Hemiteles completus, Lisonata arvicola, Polysphincta elegans, P. soror* for *Pt. pectinicornis,* and *Theocolax formiciformis, Hemiteles modestus, Pimpla flavipes, Bracon spathiiformis, Spathius clavatus, Rhogas collaris* and *Typhaeus fuscipes* for *An. striatum.*

As means of control for these insects the following may be suggested :

1) In the case of furniture or similar articles, fumigation with carbon bisulphide may be effective; linseed oil should be applied afterwards and the articles repolished. Good results may also be obtained by the application of turpentine and petroleum.

2) For wooden partitions and floors, petroleum mixed with boiling water.

3) For wood stores, carbolineum is advisable.

4) These precautions should be taken more especially in April and June, at the time when these insects are swarming.

ALFREDO RUGGERI, *gerente responsabile.*

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

# INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (*Ed.*).

FIRST PART

# THE INTERNATIONAL TRADE IN FEEDING STUFFS.

*Annual Review, No. 2.* *April 1, 1916.*

SUMMARY. — Introduction (p. 467). — World's Production of Feeding Stuffs (p. 470). — Foreign Trade of Various Countries in Feeding Stuffs (p. 487). — Prices of Feeding Stuffs (p. 495). — Bibliography (p. 500).

## INTRODUCTION.

In accordance with a resolution of the last General Assembly of the International Institute of Agriculture (1), we now publish the second Annual Review of the International Trade in Feeding Stuffs.

The preceding Review, published April 1,1915, Vol. VI, N° 4 of this Bulletin, contained a list of the available statistical data, for various countries, relating to concentrated feeding stuffs for live-stock. The object of this list — as explained in the Introduction — was to serve as a basis for the compilation of an international statistical survey of these products.

Following the plan approved by the Permanent Committee of the Institute at the meeting on December 13,1915, this Review now appears in the form of systematic statistical tables, and constitutes a first attempt to bridge a gap existing in our international agricultural statistics. These tables will contain statistical data relating to all such products for which sufficient figures are forthcoming. Data concerning other products will then be added as soon as their international movement acquires sufficient importance.

(1) INSTITUT INTERNATIONAL D'AGRICULTURE, IVème Assemblée générale, décis. 11, rapp. Pioda-Laur, 1913.

The products treated in this Review may be divided into the following categories :

a) *Residues of Milling Industry ;*
b) » » *Oil* »
c) » » *Sugar* »
d) » » *Brewing and allied Industries.*
e) » » *Animal Origin.*

For information concerning cereals and other direct agricultural produce, the reader is referred to the general statistics published in the *Annuaire international de Statistique agricole* and in the *Bulletin of Agricultural and Commercial Statistics*. At the same time, information is given wherever possible as to the relative quantity of these products utilised as concentrated foods for live-stock. Further, a special table is devoted to the foreign trade of those countries for which sufficient statistical data are in existence.

The five categories mentioned above are dealt with under the following headings.

*Production.* — The production of wheat and rye bran is taken first. This is calculated on the basis of the quantities of cereals available for consumption by means of a coefficient giving results closely approximating to the actual facts. Next comes the production of rice residues, husks and bran, this also being calculated on the basis of gross quantities available by means of a further coefficient.

Following the above will be found data relating to residues from oil extraction of oil seeds and fruits. In this case an attempt has been made, for the first time, to establish the movement of the raw materials, *i. e.*, exportation from the countries of origin and amounts available in the countries importing them ; in this way the necessary elements are obtained for calculating, again by means of a coefficient, the production of cake in each particular country.

Another method, however, has been adopted for linseed cakes, in the case of which it has been possible to make a direct determination of the quantities available in the producing and exporting countries ; similarly for cotton-seed cakes, in the case of which the chief producing country — the United States — has established special statistics ; and for rape cakes, where it has also been possible to calculate the production on the direct basis of the quantity of seed available.

The future development of this branch of our statistical work will enable us, it is hoped, to compile eventually statistics dealing with the production of cake for two other important centres : India and Egypt.

The availability data which serve as the basis of our calculations, when not already given among the elements of the present Review, are taken from the *Annuaire international de Statistique agricole*, 1913 and 1914, or from the Monthly Bulletins of Agricultural and Commercial Statistics for the years 1915 and 1916, published by the Bureau of Statistics of the Institute.

*Foreign Trade of the Various Countries.* — Export and import figures

are given in a series of ten tables for all those products which actually serve or are said to be capable of serving as concentrated foods for live-stock. We have classed together all those which, owing to similarity of production or markets, are capable of homogeneous treatment.

The first item under this heading is a table giving the amount of foreign trade in a number of cereal and pulse grains and roots, for which the quantities available for live-stock consumption are known.

*Prices.* — On account of the comparative disorganisation of the international market, we have been obliged, for the present, to restrict ourselves to giving the prices of the chief concentrates only in those markets which have remained open for international trade.

These prices will present a view of comparative price levels of such commodities.

In conclusion, it should be remarked that, wherever possible, the figures relating to production and trade have been given for the last five years, including 1915. The exceptions are formed by a certain number of belligerent countries and colonies, in the case of which the publication of statistics has been delayed. The prices, on the other hand, are those of last year only and have been calculated on the basis of London exchange. In the present state of affairs it has been impossible to give those for the preceding years.

*Bibliography.* — A list of 286 references will provide the reader with information as to the progress made in the production and employment of concentrated and other similar foods for live-stock during the past year ; they are taken from periodicals and other publications received by the International Institute of Agriculture during the period March 31, 1915 to March 31, 1916.

## PRODUCTION OF CONCENTRATED FOODS FOR LIVESTOCK.

### *Coefficients.*

As stated in the *Introduction*, the production of concentrates as considered in the present Review has been calculated on the basis of the quantities of raw materials available for consumption by the aid of certain coefficients corresponding to conditions actually obtaining in the industry.

WHEAT BRAN $= [(a + c) - (b + d)] \times \frac{25}{100}$.

RYE BRAN $= [(a + c) - (b + d)] \times \frac{32}{100}$.

$a$ = Production. $b$ = Quantity sown. $c$ = Imports. $d$ = Exports.

RICE RESIDUES.

*Producing countries:*

Husks $= [(a + c + e) - (b + d)] \times \frac{20}{100}$.

Bran $= [(a + c + e) - (b + d)] \times \frac{10}{100}$.

$a$ = Production. $b$ = Quantity sown. $c$ = Imports of rice in husk. $d$ = Exports of rice in husk. $e$ = Exports of rice not in husk.

*Non producing countries:*

Husks $= (a - b) \times \frac{20}{100}$.

Bran $= (a - b) \times \frac{10}{100}$.

$a$ = Imports of rice in husk. $b$ = Exports of rice in husk.

LINSEED CAKES $= [(a + c) - (b + d)] \times \frac{50}{100}$.

$a$ = Production. $b$ = Quantity sown. $c$ = Imports. $d$ = Exports.

COTTON CAKES. — Except in the case of the United States, for which the official factor is 43.8 % of the yield in seed, the coefficient employed for calculating the output of cake from the availability figures in the different countries is 50 %. This variation is explained by the different conditions of extraction.

RAPE CAKES $= [(a + c) - (b + d)] \times \frac{50}{100}$.

$a$ = Production. $b$ = Quantity sown. $c$ = Imports. $d$ = Exports.

OTHER KINDS OF OIL CAKES. — The production has been calculated on a basis of 50 % of the quantity available of the raw material.

RESIDUES OF BEET SUGAR INDUSTRY.

Beet slices (calculated on quantity of dry matter) = Production $\times \frac{5}{100}$.

Molasses = Production $\times \frac{2}{100}$.

## Residues of Milling Industry.

### PRODUCTION OF WHEAT BRAN

(calculated on basis of quantities of wheat available for consumption within the various countr.).

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany | 1 475 975 | 1 501 325 | 1 583 400 | ..... | ..... |
| Argentine | 297 150 | 348 525 | 447 000 | 409 025 | 351 020 |
| Austria-Hungary | 1 545 875 | 1 544 875 | 1 358 125 | ..... | ..... |
| Belgium | 505 575 | 469 725 | 479 625 | ..... | ..... |
| Bulgaria | 193 325 | 181 500 | 215 525 | 144 770 | ..... |
| Chili | 106 075 | 119 276 | 128 328 | 79 375 | ..... |
| Denmark | 54 075 | 68 950 | 76 425 | 53 979 | 67 973 |
| Egypt | 234 000 | 184 500 | 237 575 | 208 406 | 236 321 |
| Spain | 912 400 | 625 600 | 676 000 | 777 642 | ..... |
| United States | 3 522 125 | 4 094 000 | 4 019 600 | 4 241 175 | 4 782 193 |
| France | 2 484 050 | 2 206 825 | 2 318 225 | 2 140 914 | 1 845 222 |
| Algeria | 184 997 | 114 918 | 186 368 | ..... | 177 291 |
| Tunis | 28 527 | 13 604 | 37 911 | 14 250 | 59 475 |
| United Kingdom | 1 649 325 | 1 752 400 | 1 701 975 | 1 720 048 | 1 602 322 |
| Australia | 215 576 | 219 551 | 275 550 | 294 100 | 68 295 |
| Canada | 951 050 | 577 775 | 582 525 | 506 703 | 1 370 176 |
| British India | 1 829 881 | 1 699 561 | 1 795 419 | 1 602 236 | 2 038 415 |
| New Zealand | 45 025 | 47 810 | 32 226 | 33 725 | ..... |
| Italy | 1 508 125 | 1 426 625 | 1 764 775 | 1 263 720 | 1 256 832 |
| Japan | 175 417 | 182 550 | 206 700 | 162 449 | ..... |
| Norway | 6 925 | 6 000 | 7 475 | 13 974 | ..... |
| Netherlands | 119 050 | 132 950 | 139 650 | 128 118 | 186 230 |
| Portugal | 74 075 | ..... | ..... | ..... | ..... |
| Roumania | 199 675 | 197 700 | 200 875 | 120 223 | 547 522 |
| Russia in Europe and R. in Asia | 1 974 125 | 3 842 925 | 5 259 500 | 3 596 977 | ..... |
| Sweden | 93 000 | 89 800 | 107 475 | ..... | ..... |
| Switzerland | 131 600 | 138 300 | 154 225 | 131 271 | ..... |

In estimating the production of wheat bran in Germany, no allowance has been made for 3 per cent of the quantity of wheat available (the amount normally used as a concentrated food for live-stock), as this percentage is included within the limits of our calculation, (Cf. WAAGE, TH. Die Entwicklung der Futtermittelhandels in den letzten Jahren. *Der Saaten-Dünger aund Futtermarkt*, Jubiläumsausgabe, December 3 and 8 1913). For Italy, we have taken into consideration (for 1915) the new regulations with regard to milling, imposing an 80 % flour with only 20 % of offals.

With regard to the production of rye in Germany we have subtracted 10 % of the quantity available as this is the normal percentage of rye used as a concentrated food for live-stock (*Ibid.*).

PRODUCTION OF RYE BRAN

(calculated on basis of quantities of rye available for consumption).

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany | 2 790 342 | 2 894 717 | 3 045 716 | ..... | ..... |
| Austria-Hungary | 1 112 685 | 1 262 272 | 1 136 000 | ..... | ..... |
| Belgium | 233 600 | 195 008 | 216 960 | ..... | ..... |
| Bulgaria | 35 781 | 38 446 | 47 724 | ..... | ..... |
| Chili | 224 | 1 056 | 1 088 | 800 | ..... |
| Denmark | 186 329 | 179 712 | 197 012 | 120 074 | 120 333 |
| Spain | 204 640 | 122 432 | 197 504 | 157 400 | ..... |
| United States | 240 192 | 256 128 | 290 400 | 235 377 | 237 418 |
| France | 358 912 | 368 032 | 373 472 | 307 118 | 268 437 |
| Australia | 992 | 416 | 704 | ..... | ..... |
| Canada | 19 520 | 18 779 | 16 992 | 13 294 | 13 438 |
| Italy | 38 580 | 39 771 | 43 260 | 38 171 | 29 776 |
| Norway | 43 357 | 61 820 | 68 189 | 54 280 | ..... |
| Netherlands | 211 104 | 198 400 | 208 096 | 161 792 | 118 520 |
| Roumania | ..... | 4 672 | 60 896 | 1 820 | ..... |
| Russia in Europe and R. in Asia | 4 699 008 | 7 072 480 | 6 789 600 | 5 335 141 | ..... |
| Sweden | 183 155 | 198 674 | 187 008 | ..... | ..... |
| Switzerland | 19 776 | 18 652 | 18 430 | 15 001 | ..... |

## PRODUCTION OF RICE RESIDUES

(calculated on basis of quantities of rice available for consumption).

| Countries | 1911 | | 1912 | | 1913 | | 1914 | | 1915 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Husks | Bran | Husks | Bran | Husks | Bran | Husks | Bran | Husks | Bran |
| | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons |
| a) *Producing countries.* | | | | | | | | | | |
| Spain | 12 440 | 6 220 | 48 300 | 24 150 | 44 000 | 22 000 | 48 980 | 24 490 | ..... | ..... |
| United States | 87 980 | 43 990 | 100 980 | 50 490 | 103 260 | 51 630 | 96 400 | 48 200 | 120 120 | 60 060 |
| British India | 9 570 252 | ..... | 9 068 338 | ..... | 9 083 492 | ..... | 8 669 118 | ..... | ..... | ..... |
| Italy | 103 026 | 51 513 | 95 674 | 47 837 | 113 340 | 56 670 | 118 380 | 59 190 | 110 364 | 55 182 |
| Japan | 1 807 220 | ..... | 1 752 094 | ..... | 2 140 634 | ..... | 1 995 806 | ..... | ..... | ..... |
| Dutch East Indies | 1 008 926 | ..... | 1 084 461 | ..... | 1 025 346 | ..... | 1 285 414 | ..... | ..... | ..... |
| b) *non-producing countries.* | | | | | | | | | | |
| Germany | 30 600 | 15 300 | 20 074 | 10 037 | 32 678 | 16 339 | ..... | ..... | ..... | ..... |
| Argentine | 3 400 | 1 700 | 2 960 | 1 480 | 3 520 | 1 760 | 2 320 | 1 160 | ..... | ..... |
| Austria Hungary | 22 380 | 11 190 | 16 200 | 8 100 | 17 018 | 8 509 | ..... | ..... | ..... | ..... |
| Belgium | 7 020 | 3 510 | 9 840 | 4 920 | 4 400 | 2 200 | ..... | ..... | ..... | ..... |
| Denmark | 0,8 | 0,4 | 0,2 | 0,1 | 1 | 0,6 | 0,6 | 0,3 | ..... | ..... |
| France | 15 080 | 7 540 | 11 656 | 5 828 | 9 456 | 4 728 | 7 880 | 3 940 | 12 100 | 6 050 |
| Algeria | 6 | 3 | 200 | 100 | 200 | 100 | 260 | 130 | 1 400 | 700 |
| United Kingdom | 19 920 | 9 960 | 19 360 | 9 680 | 17 720 | 8 860 | ..... | ..... | ..... | ..... |
| Australia | 4 080 | 2 040 | 5 280 | 2 640 | 5 060 | 2 530 | ..... | ..... | ..... | ..... |
| Canada | 3 640 | 1 820 | 3 580 | 1 790 | 4 420 | 2 210 | 4 620 | 2 310 | 5 280 | 2 640 |
| Norway | 100 | 50 | 20 | 10 | ..... | ..... | ..... | ..... | ..... | ..... |
| Russia | 4 200 | 2 100 | 8 220 | 4 110 | 6 280 | 3 140 | ..... | ..... | ..... | ..... |
| Sweden | 2 600 | 1 300 | 2 980 | 1 490 | 2 040 | 1 020 | 2 160 | 1 080 | 4 380 | 2 190 |
| Switzerland | 2 780 | 1 390 | 1 800 | 900 | 2 760 | 1 380 | 1 920 | 960 | ..... | ..... |

## Residues of Oil Industry.

### Production of linseed cakes

(calculated on quantities of seed available).

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| a) *Producing countries.* | | | | | |
| Austria Hungary | 24 804 | 27 594 | 36 670 | ..... | ..... |
| Belgium | 42 200 | 41 725 | 56 765 | ..... | ..... |
| Bulgaria | 163 | 77 | ..... | ..... | ..... |
| Chili | 29 | 340 | 143 | ..... | ..... |
| United States | 257 308 | 369 267 | 237 164 | 234 537 | 320 959 |
| France | 55 748 | 73 609 | 119 852 | 63 600 | ..... |
| Algeria | 27 | ..... | ..... | ..... | ..... |
| Canada | 94 325 | 166 633 | ..... | ..... | 85 956 |
| British India | ..... | ..... | ..... | ..... | 8 714 |
| Italy | 23 783 | 24 410 | 27 170 | 18 944 | 21 974 |
| Japan | 747 | ..... | ..... | ..... | ..... |
| Netherlands | 70 121 | 78 495 | 102 851 | 98 271 | ..... |
| Roumania | 4 215 | 5 518 | ..... | 473 | ..... |
| Russia in Europe | 77 115 | 94 262 | 145 566 | ..... | ..... |
| Sweden | 10 135 | ..... | 14 145 | ..... | ..... |
| b) *Importing countries.* | | | | | |
| Germany | 135 000 | 162 350 | 278 100 | ..... | ..... |
| Denmark | 4 150 | 5 800 | 9 900 | 11 800 | 16 550 |
| United Kingdom | 131 500 | 134 600 | 308 900 | 231 300 | 200 600 |
| Australia | 750 | 1 400 | 1 748 | 2 289 | 3 300 |
| Norway | 4 600 | 5 000 | 7 350 | 5 600 | ..... |

## Cottonseed.

### PRODUCTION OF COTTONSEED CAKES AND MEAL IN THE UNITED STATES (based on the crop yield).

| Products | 1911 | 1912 | 1913 | 1914 | 1915 (to Dec. 1.) |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| Production of cottonseed | 6 347 573 | 5 537 457 | 5 719 801 | (6 803 887) | ..... |
| Worked cottonseed: | | | | | |
| Alabama | ..... | 314 996 | 388 681 | 455 746 | 140 396 |
| Arkansas | ..... | 226 216 | 276 730 | 285 136 | 99 851 |
| North Carolina | ..... | 281 046 | 288 444 | 351 775 | 107 678 |
| South » | ..... | 306 281 | 226 543 | 372 611 | 73 644 |
| Florida | ..... | 17 299 | 21 455 | 30 073 | 11 800 |
| Georgia | ..... | 572 285 | 781 247 | 956 107 | 327 494 |
| Louisiana | ..... | 137 658 | 139 276 | 159 596 | 63 506 |
| Mississipi | ..... | 357 100 | 455 703 | 478 907 | 162 177 |
| Missouri | ..... | 20 338 | 25 396 | 29 235 | 8 554 |
| Oklahoma | ..... | 308 946 | 373 118 | 417 492 | 145 312 |
| Tennessee | ..... | 149 416 | 235 465 | 252 134 | 82 425 |
| Texas | ..... | 1 425 157 | 1 058 112 | 1 373 936 | 555 370 |
| Other States | ..... | 37 723 | 55 109 | 79 978 | 19 053 |
| | 4 464 324 | 4 154 461 | 4 325 279 | 5 243 226 | (1 797 260) |
| Production of cakes and meal | 1 951 355 | 1 813 463 | (1 896 017) | (2 296 532) | (787 200) |

### EXPORTS OF COTTONSEED BY PRODUCING COUNTRIES.

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| China | 13 479 | 18 598 | 11 032 | 14 862 | (1) |
| Egypt | 463 207 | 472 302 | 373 703 | 346 060 | 367 742 |
| United States (year ending June 30) | 5 998 | 29 057 | 10 908 | 7 413 | 2 864 |
| British possessions: | | | | | |
| India | 193 103 | 14 4230 | 218 307 | 329 526 | 67 072 |
| Uganda (year ending March 31). | 1 630 | 29 74 | 5 704 | (1) | (1) |
| | 194 733 | 147 204 | 224 011 | ..... | ..... |
| | 677 417 | 667 161 | 619 654 | (697 861) | (437 678) |

(1) Figures not available.

## COTTONSEED TRADE OF IMPORTING COUNTRIES.

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| **Germany :** | | | | | |
| imports | 155 785 | 214 097 | 219 797 | (2) 120 973 | (1) |
| exports | 2 337 | 1 802 | 809 | (2) 230 | (1) |
| | 153 448 | 212 295 | 218988 | 120 743 | ..... |
| **Austria-Hungary :** | | | | | |
| imports | 5 802 | 11 233 | 3 813 | (2) 2 096 | (1) |
| exports | ..... | 1 498 | 1255 | ..... | (1) |
| | 5 802 | 9 735 | 2 558 | 2 096 | ..... |
| **France :** | | | | | |
| imports | 30 555 | 34 935 | 17 670 | 14 742 | 2 303 |
| exports | 267 | 141 | 925 | 708 | 1 955 |
| | 30 288 | 34 794 | 16 745 | 14 034 | 348 |
| **United Kingdom :** | | | | | |
| imports | 60 470 | 63 995 | 62 932 | 76 122 | 32 367 |
| **Japan :** | | | | | |
| imports | 11 894 | ..... | 12 039 | 14 373 | (3) 23 915 |

(1) Figures not available. — (2) 1st half-year. — (3) 11 months.

## PRODUCTION OF COTTONSEED CAKES IN IMPORTING COUNTRIES

(calculated on quantities of seed available).

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany | 76 724 | 106 147 | 109 494 | 60 371 | ..... |
| Austria-Hungary | 2 901 | 4 867 | 1 279 | 1 048 | ..... |
| France | 15 144 | 17 397 | 8 372 | 7 017 | 174 |
| United Kingdom | 30 235 | 31 997 | 31 466 | 38 061 | 16 183 |
| Japan | 5 947 | ..... | 6 019 | 7 186 | 11 957 |

## Production of rape cakes

(calculated on quantities of seed available).

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany | 7 142 | 59 293 | 74 227 | 33 182 | ..... |
| Austria-Hungary | 147 378 | 19 001 | 22 006 | 4 216 | ..... |
| Belgium | 22 661 | 17 645 | 18 595 | 11 825 | ..... |
| Denmark | 1 585 | 44 906 | 24 211 | 13 153 | ..... |
| France | 60 455 | 1 562 | 1 072 | 19 | 4 035 |
| Great Britain and Ireland | 21 721 | 17 429 | 25 055 | 29 176 | 18 146 |
| British India | 486 146 | 547 269 | 504 405 | 426 865 | ..... |
| Italy | 3 351 | 1 604 | 5 091 | 10 988 | 2 254 |
| Japan | 65 068 | 74 490 | 134 568 | 12 754 | 26 133 |
| Norway | 203 | 128 | 482 | 255 | 226 |
| Netherlands | 17 778 | 15 357 | 15 877 | 10 091 | 7 787 |
| Sweden | 580 | 723 | 457 | 94 | ..... |

### Ground-Nuts.

In the case of ground-nuts, figures are given both for whole pods and for the hulled seeds. As, however, the yield in cake must be based upon the quantities of the latter, we have converted the figures for the whole pods into their equivalents in hulled seed by allowing a normal yield of 75 per cent.

In addition to the data for ground-nuts, systematic statistics are given for the first time relating to other oil seeds and fruits in the chief producing countries. These products are daily growing in importance, not only in the economy of various colonies but also in their capacity as the basal material of such important concentrates in modern feeding practice as sesame, copra and palm-kernel cake. It is intended, later on, to treat of other similar products which are not yet of sufficient general importance *e. g.* soya, mowrah, perilla etc.

## EXPORTATION OF GROUND-NUTS BY PRODUCING COUNTRIES.

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| German colonies: | | | | | |
| Former German E. Africa.... | 2 506 | 6 079 | (1) | (1) | (1) |
| China: | | | | | |
| *in hulls*..... | *64 920* | *51 793* | *63 741* | *22 353* | (1) |
| equivalent in hulled seeds. | 48 690 | 38 845 | 47 806 | 16 765 | ..... |
| hulled seeds..... | ..... | ..... | 5 263 | 6 802 | (1) |
| | 48 690 | 38 845 | (53 069) | (23 567) | ..... |
| Egypt*..... | 877 | 794 | 557 | 296 | 163 |
| French colonies: | | | | | |
| Senegal: | | | | | |
| *in hulls*..... | *164 908* | *184 762* | (1) | (1) | (1) |
| equivalent in hulled seeds.. | 123 681 | 130 571 | ..... | ..... | ..... |
| Upper Senegal and Niger: | | | | | |
| *in hulls*..... | *5 111* | *1 761* | (1) | (1) | (1) |
| equivalent in hulled seeds.. | 3 833 | 1 321 | ..... | ..... | ..... |
| hulled seeds..... | ..... | 5 830 | (1) | (1) | (1) |
| French Guinea: | | | | | |
| *in hulls*..... | *1 056* | *2 020* | (1) | (1) | (1) |
| equivalent in hulled seeds.. | 792 | 1 515 | ..... | ..... | ..... |
| Mayotte and dependencies: | | | | | |
| *in hulls*..... | *34* | *34* | (1) | (1) | (1) |
| equivalent in hulled seeds.. | 25 | 25 | ..... | ..... | ..... |
| Indo-China: | | | | | |
| hulled seeds..... | 202 | 405 | (1) | (1) | (1) |
| French possessions in India: | | | | | |
| *in hulls*..... | *10* | *9* | ..... | ..... | ..... |
| equivalent in hulled seeds.. | 7 | 7 | ..... | ..... | ..... |
| hulled seeds..... | 76 | 213 | ..... | ..... | ..... |
| | 128 616 | 134 057 | ..... | ..... | ..... |
| British colonies: | | | | | |
| India..... | 204 240 | 221 679 | 259 158 | 266 050 | 131 676 |
| Gambia..... | 48 700 | 65 199 | 68 486 | ..... | ..... |
| Nigeria: | | | | | |
| *in hulls*..... | *890* | *1 743* | (1) | (1) | (1) |
| equivalent in hulled seeds.. | 667 | 1 307 | ..... | ..... | ..... |
| hulled seeds..... | 1 198 | 2 559 | (1) | (1) | (1) |
| | 254 805 | 290 744 | (327 644) | (266 050) | (131 676) |
| Japan..... | 4 679 | 3 919 | 5 928 | 5 556 | (2) 5 173 |
| Dutch colonies: | | | | | |
| East-Indies: | | | | | |
| *in hulls*..... | ..... | *3 266* | *13 793* | *9 974* | (1) |
| equivalent in hulled seeds.. | (1) | 2 449 | 10 345 | 7 480 | ..... |
| hulled seeds..... | (1) | 9 940 | 6 268 | 7 655 | (1) |
| Portuguese colonies: | ..... | 12 389 | 16 613 | 15 135 | ..... |
| Portuguese S. E. Africa..... | (1) | 5 113 | (1) | (1) | (1) |
| | (440 173) | (491 940) | (403 811) | (310 604) | (137 012) |

* Exported for direct consumption. — (1) Figures not available. — (2) 11 months.

## GROUND-NUT TRADE OF IMPORTING COUNTRIES.

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany: | | | | | |
| imports | 44 534 | 69 869 | 98 085 | (2) 83 940 | (1) |
| Denmark: | | | | | |
| imports | 2 074 | 1 188 | 3 666 | (2) 2 418 | (1) |
| United States: (years ending June 30): | | | | | |
| imports: | | | | | |
| *in hulls* | *7 844* | *5 865* | *5 571* | *7 925* | *6 596* |
| equivalent in hulled seeds | 5 883 | 4 399 | 4 178 | 5 944 | 4 947 |
| hulled seeds | ..... | 1 192 | 3 085 | 12 282 | 4 374 |
| | 5 883 | 5 591 | 7 263 | 18 226 | 9 321 |
| France: | | | | | |
| imports: | | | | | |
| *in hulls* | *216 770* | *222 380* | *255 713* | *270 194* | *255 713* |
| equivalent in hulled seeds | 162 577 | 166 785 | 191 785 | 202 645 | 191 785 |
| hulled seeds | 178 379 | 245 236 | 237 754 | 269 814 | 237 754 |
| | 340 956 | 412 021 | 429 539 | 472 459 | 429 539 |
| exports: | | | | | |
| *in hulls* | *15 137* | *13 644* | *16 999* | *12 634* | *8 015* |
| equivalent in hulled seeds | 11 353 | 10 233 | 12 749 | 9 475 | 6 011 |
| hulled seeds | 4 358 | 5 665 | 2 192 | 1 909 | 3 615 |
| | 15 711 | 15 898 | 14 941 | 11 384 | 9 626 |
| | 325 245 | 396 123 | 414 598 | 461 075 | 419 913 |
| Netherlands: | | | | | |
| imports | 47 582 | 52 179 | 67 428 | 64 167 | 47 416 |
| exports | 12 762 | 12 794 | 19 616 | 21 700 | 6 548 |
| | 34 820 | 39 385 | 47 812 | 42 467 | 40 868 |

(1) Figures not available. — (2) 1st. half-year.

## PRODUCTION OF GROUND-NUT CAKES IN IMPORTING COUNTRIES

(calculated on quantities available for consumption).

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany | 22 267 | 34 934 | 49 042 | 41 970 | ..... |
| Denmark | 1 037 | 594 | 1 833 | 1 209 | ..... |
| United States | 2 941 | 2 795 | 3 631 | 9 113 | 4 660 |
| France | 162 622 | 198 061 | 207 299 | 230 537 | 209 956 |
| Netherlands | 17 410 | 19 692 | 23 906 | 21 233 | 20 434 |

## Sesame.

### EXPORTATION OF SESAME BY PRODUCING COUNTRIES.

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| German colonies: | | | | | |
| Former German E. Africa .... | 1 514 | 1 881 | (1) | (1) | (1) |
| China ..... | 125 324 | 120 892 | 123 001 | 75 638 | (1) |
| Ottoman Empire * ..... | 18 402 | 12 192 | (1) | (1) | (1) |
| French colonies: | | | | | |
| Upper Senegal and Niger..... | 12 | 7 | (1) | (1) | (1) |
| French Guinea ..... | 564 | 411 | (1) | (1) | (1) |
| Indo-China ..... | 1 030 | 894 | (1) | (1) | (1) |
| | 1 606 | 1 312 | (1) | (1) | (1) |
| British possessions: | | | | | |
| India..... | 136 313 | 62 360 | 104 069 | 100 940 | 11 293 |
| Sudan ..... | 4 935 | 6 094 | 6 839 | (1) | (1) |
| British E. Africa (year ending March 31) ..... .. | 2 060 | 3 494 | 4 088 | 3 871 | (1) |
| Uganda (year ending March 31) | 538 | 709 | 1 596 | 910 | (1) |
| Nigeria..... | 469 | 448 | 1 055 | (1) | (1) |
| Sierra Leone..... | 112 | 46 | 36 | (1) | (1) |
| | 144 427 | 73 151 | 117 683 | 105 721 | 11 293 |
| Portuguese colonies: | | | | | |
| Portuguese E. Africa ..... | (1) | 1 330 | (1) | (1) | (1) |
| | (1) | 1 330 | (1) | (1) | (1) |
| Dutch colonies: | | | | | |
| Dutch E. Indies..... | (1) | 1 302 | 1 987 | 2 445 | (1) |
| | (146 033) | 77 095 | (118 670) | (108 166) | (11 293) |

* The figure for 1911 refers to the year ending March 13; that for 1912 to the exports from the ports of Haifa, Gaffa, Mersina, Adalia, Ayas and Smyrna. — (1) Figures not available.

## SESAME TRADE OF PRODUCING COUNTRIES.

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany : | | | | | |
| imports | 101 672 | 99 282 | 116 039 | (2) 88 237 | (1) |
| Austria-Hungary: | | | | | |
| imports | 42 200 | 31 414 | 26 629 | (2) 17 189 | (1) |
| exports | 24 | 4 | 455 | (2) 1 | (1) |
| | 42 176 | 31 410 | 26 174 | 17 188 | — |
| Denmark : | | | | | |
| imports | 6 397 | 2 544 | 4 018 | (2) 4 396 | (1) |
| France : | | | | | |
| imports | 98 373 | 19 611 | 20 586 | 21 675 | 15 874 |
| exports | 2 669 | 1 414 | 925 | 708 | 1 955 |
| | 95 704 | 18 197 | 19 661 | 20 967 | 13 919 |
| Italy * : | | | | | |
| imports | 40 876 | 25 358 | 24 774 | 28 863 | (3) 32 645 |
| exports | 19 | 27 | 16 | 26 | 12 |
| | 40 857 | 25 331 | 24.758 | 28 837 | 32 633 |
| Japan : | | | | | |
| imports | 4 774 | 5 970 | 5 955 | 6 744 | (4) 9 717 |
| Russia : | | | | | |
| imports | 3 878 | 3 999 | ..... | ..... | ..... |

* Sesame and Ground-nuts. — (1) Figures not available. — (2) 1st half-year. — (3) 10 months. — (4) 11 months.

## PRODUCTION OF SESAME CAKE IN IMPORTING COUNTRIES.

(calculated on quantities available for consumption).

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany | 50 836 | 49 641 | 58 019 | 44 118 | ..... |
| Austria-Hungary | 21 088 | 15 705 | 13 087 | 8 594 | ..... |
| Denmark | 3 198 | 1 272 | 2 009 | 2 198 | ..... |
| France | 47 852 | 9 098 | 9 830 | 10 483 | 6 959 |
| Italy | 20 428 | 12 665 | 12 379 | 14 418 | 16 316 |
| Japan | 2 387 | 2 985 | 2 977 | 3 372 | 4 858 |
| Russia | 1 939 | 1 999 | ..... | ..... | ..... |

## Copra.

### EXPORTATION OF COPRA BY PRODUCING COUNTRIES.

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| German colonies: | | | | | |
| Former German E. Africa | 5 421 | 4 242 | (1) | (1) | (1) |
| Togoland | 189 | 163 | (1) | (1) | (1) |
| New Guinea and dependencies | 14 523 | 17 391 | (1) | (1) | (1) |
| Samoa | 10 237 | 11 201 | (1) | (1) | (1) |
| | 30 370 | 32 907 | ..... | ..... | ..... |
| United States, Philippines | 138 573 | 141 200 | 76 000 | (1) | (1) |
| French colonies: | | | | | |
| Ivory coast | 22 | 22 | (1) | (1) | (1) |
| Dahomey and dependencies | 350 | 301 | (1) | (1) | (1) |
| Gaboon | ..... | 1 | (1) | (1) | (1) |
| Indo-China | 7 559 | 7 982 | (1) | (1) | (1) |
| New Caledonia and dependencies | 2 561 | 2 856 | (1) | (1) | (1) |
| French possessions in Oceania | 8 683 | 6 113 | (1) | (1) | (1) |
| | 19 175 | 17 275 | ..... | ..... | ..... |
| British possessions: | | | | | |
| India (year ending March 31) | ..... | 32 387 | 34 901 | 38 804 | 32 356 |
| Ceylon | 41 750 | 31 197 | 59 555 | ..... | ..... |
| Federated Malay States | 8 181 | 7 831 | 9 436 | 14 732 | 6 316 |
| British Borneo | 537 | 569 | 655 | (1) | (2) |
| Sarawak | 100 | 103 | 71 | (1) | (1) |
| Seychelles | 2 590 | 2 735 | 2 984 | 3 671 | (1) |
| Mauritius | 2 | 8 | 99 | (1) | (1) |
| Tonga | 12 925 | 11 298 | 3 481 | (1) | (1) |
| Fiji | 16 599 | 13 930 | 8 056 | (1) | (1) |
| Brit. N. Guin. (year end. Mar. 31) | 1 077 | 1 009 | 807 | 1 220 | (1) |
| Solomon Isles (British) | 205 | 182 | 213 | 295 | (1) |
| Gilbert and Ellice Islands | 2 103 | (1) | (1) | (1) | (1) |
| Brit. E. Afr. (year ending Mar. 31) | 1 874 | 1 611 | 1 589 | 1 612 | (1) |
| Zanzibar | 11 501 | 9 482 | 9 603 | 10 138 | (1) |
| Gold Coast | 792 | 630 | 640 | (1) | (1) |
| Nigeria | 98 | 96 | 98 | (1) | (1) |
| Trinity | 754 | 1 433 | 524 | (1) | (1) |
| Jamaica | 8 | 21 | 32 | (1) | (1) |
| British Guiana | (1) | 58 | 57 | (1) | (1) |
| | (101 096) | (114 580) | (132 801) | (70 472) | (38 672) |
| Dutch colonies: | | | | | |
| Java | 91 622 | 84 650 | 78 800 | 70 827 | (1) |
| Macassar | 38 964 | 37 822 | 29 570 | | (1) |
| Saugir, Menado, Gorontalo | 33 914 | 30 076 | 26 648 | 172 847 | (1) |
| Padang | 14 383 | 17 351 | 17 617 | | (1) |
| | 178 883 | 169 899 | 152 635 | 243 674 | (1) |
| Portuguese colonies: | | | | | |
| Portuguese E. Africa | 4 004 | (1) | (1) | (1) | (1) |
| | (472 101) | (475 861) | (361 436) | (70 472) | (38 672) |

(1) Figures not available. — (2) 1st half-year.

## COPRA TRADE OF IMPORTING COUNTRIES.

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany: | | | | | |
| imports | 148 066 | 183 258 | 196 449 | (2) 82 956 | (1) |
| exports | 1 332 | 981 | 549 | (2) 573 | (1) |
| | 146 734 | 182 277 | 195 900 | 82 383 | ..... |
| Austria-Hungary: | | | | | |
| imports | 48 212 | 45 537 | 33 305 | (2) 14 882 | (1) |
| exports | ..... | ..... | ..... | (2) | (1) |
| | 48 212 | 45 537 | 33 305 | 14 882 | ..... |
| Belgium: | | | | | |
| imports | 21 778 | 25 774 | 19 552 | (2) 11 118 | (1) |
| exports | 6 744 | 7 170 | 6 957 | (2) 4 707 | (1) |
| | 15 034 | 18 604 | 12 595 | 6 411 | ..... |
| Denmark: | | | | | |
| imports | 25 005 | 24 595 | 31 144 | 13 690 | (1) |
| United States (year ending June 30) | | | | | |
| imported for consumption | 17 153 | 31 707 | 18 647 | 25 266 | 43 686 |
| France: | | | | | |
| imports | 167 392 | 153 506 | 112 640 | 96 363 | 131 371 |
| exports | 47 | 92 | 312 | 68 | 369 |
| | 167 345 | 153 414 | 112 328 | 96 295 | 131 018 |
| United Kingdom: | | | | | |
| imports | (3) | (3) | 14 432 | 42 837 | (3) |
| Japan: | | | | | |
| imports | 2 527 | 2 908 | 2 558 | 3 038 | (4) 3 970 |
| Netherlands: | | | | | |
| imports | 91 730 | 102 230 | 100 635 | 109 420 | 210 288 |
| exports | 78 014 | 78 350 | 82 356 | 77 108 | 106 845 |
| | 13 716 | 23 880 | 18 279 | 32 312 | 103 443 |
| Russia: | | | | | |
| imports | 73 162 | 63 906 | ..... | ..... | ..... |

(1) Figures not available. — (2) 1st half-year. — (3) Not specified. — (4) 11 months.

## PRODUCTION OF COPRA CAKE IN IMPORTING COUNTRIES

(calculated on quantities available for consumption within the various countries).

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany | 73 367 | 91 138 | 97 950 | 41 191 | ..... |
| Austria-Hungary | 24 106 | 22 768 | 16 652 | 7 441 | ..... |
| Belgium | 7 517 | 9 302 | 6 297 | 3 205 | ..... |
| Denmark | 12 502 | 12 272 | 15 572 | 6 845 | ..... |
| United States | 8 576 | 15 853 | 9 323 | 12 633 | 21 843 |
| France | 83 672 | 76 707 | 56 164 | 48 147 | 65 509 |
| United Kingdom | ..... | ..... | 7 216 | 21 418 | ..... |
| Japan | 1 263 | 1 454 | 1 279 | 1 519 | 1 985 |
| Netherlands | 6 858 | 11 940 | 9 139 | 16 156 | 51 721 |
| Russia | 36 581 | 31 953 | ..... | ..... | ..... |

### Oil-palm.

## EXPORTATION OF PALM KERNELS BY PRODUCING COUNTRIES.

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| German colonies: | | | | | |
| Cameroon | 15 171 | 15 999 | (1) | (1) | (1) |
| Togoland | 13 287 | 11 639 | (1) | (1) | (1) |
| | 28 458 | 27 638 | | | |
| French colonies: | | | | | |
| Senegal | 1 327 | 1 764 | (1) | (1) | (1) |
| Upper Senegal and Niger * | 243 | 847 | (1) | (1) | (1) |
| French Guinea | 4 826 | 5 135 | (1) | (1) | (1) |
| Ivory Coast | 5 251 | 6 799 | (1) | (1) | (1) |
| Dahomey and dep. | 39 346 | 37 296 | (1) | (1) | (1) |
| Gaboon | 495 | 359 | (1) | (1) | (1) |
| Indo-China | 8 | 42 | (1) | (1) | (1) |
| | 51 496 | 52242 | | | |
| British possessions: | | | | | |
| Nigeria | 179 220 | 187 587 | 177 524 | 165 058 | 156 370 |
| Sierra Leone | 43 580 | 515 740 | 49 991 | (1) | (1) |
| Gold Coast | 13 467 | 14 864 | 9 899 | (1) | (1) |
| Gambia | 450 | 452 | 554 | (1) | (1) |
| | 236 717 | 718 643 | 237 968 | (165 058) | (156 370) |
| | 316 671 | 798 523 | 237 968 | (165 058) | (156 370 |

(*) Kernels of *Butyrospermum*. — (1) Figures not available.

## TRADE IN PALM KERNELS OF IMPORTING COUNTRIES.

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany : | | | | | |
| imports | 250 664 | 261 408 | 235 917 | (2) 113 205 | (1) |
| exports | (3) | (3) | (3) | (3) | |
| Austria-Hungary : | | | | | |
| imports | 30 040 | 39 906 | 27 043 | (2) 1 127 | (1) |
| exports | ..... | ..... | ..... | ..... | ..... |
| Belgium : | | | | | |
| imports | 4 265 | 6 402 | 4 265 | (2) 2 262 | (1) |
| exports | 790 | 565 | 790 | (2) 698 | (1) |
| | 3 475 | 5 837 | 3 475 | 1 564 | ..... |
| Denmark : | | | | | |
| imports | 1 495 | 1 773 | 595 | (2) 406 | (1) |
| France : | | | | | |
| imports | 1 988 | 2 077 | 2 986 | 3 135 | 18 463 |
| exports | 10 | 40 | 12 | 7 | 4 |
| | 1 978 | 2 037 | 2 974 | 3 128 | 18 459 |
| United Kingdom : | | | | | |
| imports for consumption | (3) | (3) | (3) | 66 665 | (3) |
| Italy : | | | | | |
| imports * | 204 | 254 | 110 | 343 | (4) 519 |
| Netherlands : | | | | | |
| imports | 42 845 | 56 863 | 63 711 | 56 187 | 25 829 |
| exports | 43 119 | 48 439 | 57 563 | 35 534 | 83 |
| | — 274 | 8 424 | 6 148 | 20 653 | 25 746 |

* Of *Bassia, Stillingia* and *Elaeis*. — (1) Figures not available. — (2) 1st half-year. — (3) Not specified. — (4) 10 months.

## PRODUCTION OF PALM KERNEL CAKES IN IMPORTING COUNTRIES
(calculated on quantities available for consumption).

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany | 125 332 | 130 704 | 117 958 | 56 602 | ..... |
| Austria-Hungary | 15 020 | 19 953 | 13 521 | 563 | ..... |
| Belgium | 1 737 | 2 918 | 1 737 | 782 | ..... |
| Denmark | 747 | 886 | 297 | 203 | ..... |
| France | 989 | 1 018 | 1 487 | 1 564 | 9 229 |
| United Kingdom | ..... | ..... | ..... | 33 332 | ..... |
| Italy | 102 | 127 | 55 | 171 | 259 |
| Netherlands | ..... | 4 212 | 3 074 | 10 326 | 12 873 |

## Residues of Sugar Industry.

### PRODUCTION OF BEET RESIDUES.

| Countries | 1911 | 1912 | 1913 | 1914 | 1915 |
|---|---|---|---|---|---|
| | metric tons | metric tons | metric tons | metric tons | metric tons |
| | a) *Dried slices.* | | | | |
| Germany | 453 030 | 832 110 | 847 000 | 845 940 | ..... |
| Austria | 212 490 | 396 190 | 348 100 | 338 740 | ..... |
| Hungary | 149 380 | 241 985 | 243 250 | 200 715 | 124 425 |
| Belgium | 75 335 | 86 515 | 69 595 | ..... | ..... |
| Bulgaria | 3 260 | 3 065 | 4 250 | 15 000 | ..... |
| Denmark | 36 525 | 49 300 | 46 500 | 48 365 | 41 300 |
| Spain | 39 590 | 39 590 | 59 100 | ..... | ..... |
| United States | 229 625 | 236 975 | 256 690 | 253 330 | 293 110 |
| France | 211 790 | 361 105 | 301 505 | 187 555 | 75 410 |
| Australia | 310 | 205 | 320 | 380 | ..... |
| Canada | 7 940 | 9 115 | 6 715 | 4 925 | 6 420 |
| Italy | 79 220 | 87 150 | 136 500 | 67 500 | 75 000 |
| Netherlands | 100 250 | 108 805 | 83 265 | 99 710 | 83 305 |
| Roumania | 13 155 | 14 610 | 14 120 | 11 250 | ..... |
| Russia in Europe | 677 220 | 536 200 | 617 585 | ..... | ..... |
| » » Asia | 470 | ..... | ..... | ..... | ..... |
| Serbia | 4 585 | 7 500 | ..... | ..... | ..... |
| Sweden | 48 275 | 42 325 | 42 260 | 43 865 | ..... |
| Switzerland | 1 155 | ..... | 1 580 | 1 350 | 1 250 |
| | b) *Molasses.* | | | | |
| Germany | 181 212 | 332 844 | 338 800 | 338 376 | ..... |
| Austria | 84 996 | 158 476 | 139 240 | 135 496 | ..... |
| Hungary | 59 752 | 96 794 | 97 300 | 80 286 | 49 770 |
| Belgium | 30 134 | 34 606 | 27 838 | ..... | ..... |
| Bulgaria | 1 304 | 1 226 | 1 700 | 6 000 | ..... |
| Denmark | 14 610 | 19 720 | 18 600 | 19 346 | 16 520 |
| Spain | 15 836 | 15 836 | 23 640 | ..... | ..... |
| United States | 91 850 | 94 790 | 102 676 | 101 332 | 117 244 |
| France | 84 716 | 144 442 | 120 602 | 75 022 | 30 164 |
| Australia | 124 | 82 | 128 | 152 | ..... |
| Canada | 3 176 | 3 646 | 2 686 | 1 970 | 2 568 |
| Italy | 31 688 | 34 860 | 54 600 | 27 000 | 30 000 |
| Netherlands | 40 100 | 43 522 | 33 306 | 39 884 | 33 322 |
| Roumania | 5 262 | 5 844 | 5 648 | 4 500 | ..... |
| Russia in Europe | 270 888 | 214 480 | 24 7034 | ..... | ..... |
| » » Asia | 188 | ..... | ..... | ..... | ..... |
| Serbia | 1 834 | 3 000 | ..... | ..... | ..... |
| Sweden | 19 310 | 16 930 | 16 904 | 17 546 | ..... |
| Switzerland | 462 | ..... | 632 | 540 | 500 |

## Direct Agricultural Produce.

FOREIGN TRADE IN CEREAL GRAINS, PULSE AND ROOTS, USED IN FEEDING LIVE-STOCK.

| Countries | Imports | | | | | Exports | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1911 | 1912 | 1913 | 1914 | 1915 | 1911 | 1912 | 1913 | 1914 | 1915 |
| | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons |
| **Germany:** | | | | | | | | | | |
| Barley | 3 477 980 | 2 756 925 | 3 087 067 | (1) 1 600 495 | (2) | 1 854 | 1 157 | 6 018 | (1) 2 216 | (2) |
| Beans | 24 800 | 25 565 | 15 290 | (1) 7 040 | (2) | 299 | 170 | 872 | (1) 365 | (2) |
| Lupins | 17 613 | 13 280 | 6 689 | (1) 8 557 | (2) | 836 | 478 | 727 | (1) 637 | (2) |
| Vetches | 21 627 | 25 181 | 15 263 | (1) 12 000 | (2) | 1 227 | 1 295 | 924 | (1) 471 | (2) |
| **Austria-Hungary:** | | | | | | | | | | |
| Vetches | 5 758 | 6 167 | 565 | (1) 2 762 | (2) | 3 132 | 3 748 | 2 306 | (1) 696 | (2) |
| **Belgium:** | | | | | | | | | | |
| Seeds and their non-food derivatives, other than bran | 2 627 | 1 691 | 1 344 | (1) 544 | (2) | 3 132 | 3 748 | 2 306 | (1) 696 | (2) |
| **French colonies:** | | | | | | | | | | |
| **Indo-China:** | | | | | | | | | | |
| Dried manioc | ..... | ..... | ..... | ..... | ..... | 2 168 | 1 468 | 1 493 | (2) | (2) |
| **Netherlands:** | | | | | | | | | | |
| Wheat | 15 914 | 17 905 | 21 616 | (2) | (2) | 12 565 | 14 001 | 17 308 | (2) | (2) |
| Rye | 7 166 | 5 575 | 6 554 | (2) | (2) | 4 073 | 2 892 | 3 805 | (2) | (2) |
| Barley | 11 269 | 8 368 | 11 137 | (2) | (2) | 8 446 | 6 520 | 8 507 | (2) | (2) |
| Buckwheat | 224 | 259 | 206 | (2) | (2) | 77 | 59 | 6 768 | (2) | (2) |
| Beans and vetches | 442 | 389 | (2) | (2) | (2) | 301 | 252 | (2) | (2) | (2) |
| **Dutch colonies:** | | | | | | | | | | |
| **Dutch E. Indies:** | | | | | | | | | | |
| Dried roots | ..... | ..... | ..... | ..... | ..... | (2) | 12 903 | 14 158 | 6 541 | (2) |
| and residues of manioc | ..... | ..... | ..... | ..... | ..... | (2) | 17 313 | 25 940 | 17 947 | (2) |

(1) 1st half-year. — (2) Figures not available.

## Residues of Milling Industry.

### FOREIGN TRADE IN BRAN (wheat, etc.).

| Countries | Imports | | | | | Exports | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1911 | 1912 | 1913 | 1914 | 1915 | 1911 | 1912 | 1913 | 1914 | 1915 |
| | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany | 1 420 717 | 1 606 250 | 1 414 256 | (1) 610 703 | (2) | 16 422 | 16 708 | 23 284 | (1) 13 139 | (2) |
| Argentine | ..... | ..... | ..... | ..... | ..... | 214 634 | 325 226 | 274 058 | 230 934 | 145 449 |
| Austria-Hungary | 139 284 | 147 882 | 140 924 | (1) 66 334 | (2) | 60 415 | 37 183 | 30 591 | (1) 23 680 | (2) |
| Belgium | 72 015 | 55 776 | 73 174 | (1) 45 843 | (2) | 34 229 | 42 908 | 22 048 | (1) 16 501 | ..... |
| China | 89 468 | 59 368 | 127 561 | 106 515 | ..... | 34 535 | 45 137 | 62 109 | 25 863 | ..... |
| Denmark | 43 576 | 55 277 | 45 221 | (1) 21 365 | (2) | ..... | ..... | ..... | ..... | ..... |
| Spain | 15 | 1 555 | 5 209 | 68 | 8 | 2 783 | 3 999 | 215 | 400 | 1 301 |
| United States | ..... | ..... | ..... | ..... | ..... | 109 715 | 85 290 | 4 670 | 5 281 | ..... |
| France | 157 439 | 171 688 | 231 931 | 201 852 | 16 145 | 33 245 | 36 888 | 35 549 | 11 478 | 9 854 |
| Algeria | ..... | ..... | ..... | ..... | ..... | 19 363 | 14 651 | 19 935 | 14 116 | 9 128 |
| Tunis | ..... | ..... | ..... | ..... | ..... | 1 788 | 2 586 | ..... | ..... | ..... |
| United Kingdom | 201 861 | 209 674 | 232 666 | 248 472 | 419 030 | 163 710 | 317 121 | 162 018 | 84 118 | 2 679 |
| Australia | 3 | 2 048 | 424 | ..... | ..... | 9 767 | 6 706 | 12 222 | ..... | ..... |
| Canada (year end. Mar. 31) | ..... | ..... | ..... | ..... | ..... | 95 106 | 81 077 | 84 450 | 105 552 | 52 739 |
| British India | 3 458 | 2 764 | 3 850 | 2 582 | 2 673 | 203 914 | 244 291 | 244 250 | 193 326 | 196 351 |
| Italy | 15 495 | 9 187 | 10 618 | 4 287 | (3) 3 449 | 17 626 | 28 155 | 31 823 | 37 275 | (3) 5 337 |
| Japan | ..... | 28 184 | 39 558 | 14 989 | 18 450 | ..... | ..... | ..... | ..... | ..... |
| Norway | ..... | ..... | ..... | ..... | ..... | 36 254 | 21 256 | 15 975 | 10 992 | 40 |
| Netherlands | 90 695 | 40 646 | 43 826 | (2) | (2) | 56 303 | 66 575 | 63 937 | (2) | (2) |
| Dutch Indies | ..... | 7 477 | 7 172 | 9 045 | ..... | ..... | 585 | 324 | 494 | ..... |
| Russia | ..... | ..... | ..... | ..... | ..... | 803 363 | 835 207 | 794 000 | 448 300 | (4) 71 600 |
| Sweden — wheat | 58 413 | 58 485 | 55 780 | 46 386 | (1) 20 420 | 3 280 | 2 029 | 1 250 | 2 236 | ..... |
| Sweden — other than wheat | 3 925 | 2 945 | 2 461 | 1 581 | | 4 372 | 23 005 | 24 165 | 8 317 | ..... |
| Switzerland | 11 454 | 14 908 | 10 151 | 5 143 | ..... | 17 868 | 14 304 | 17 057 | 11 123 | ..... |

(1) 1st half-year. — (2) Figures not available. — (3) 10 months. — (4) 11 months.

## FOREIGN TRADE IN RICE RESIDUES (bran, etc.).

| Countries | Imports | | | | | Exports | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1911 | 1912 | 1913 | 1914 | 1915 | 1911 | 1912 | 1913 | 1914 | 1915 |
| | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany | 169 960 | 213 741 | 206 475 | (1) 87 450 | (2) | 4 410 | 7 285 | 4 068 | (1) 3 635 | (2) |
| Argentine | ..... | ..... | ..... | ..... | ..... | 2 519 | 2 159 | 2 574 | 1 301 | ..... |
| Austria-Hungary | 9 619 | 13 876 | 5 816 | (1) 2 092 | (2) | 26 247 | 15 747 | 11 079 | (1) 2 544 | (2) |
| Denmark | 2 340 | 3 380 | 4 495 | (2) | (2) | ..... | ..... | ..... | ..... | ..... |
| France | 42 557 | 26 718 | 50 419 | 76 980 | 71 740 | 3 687 | 2 266 | 9 645 | 28 864 | 16 779 |
| Indo-China | ..... | ..... | ..... | ..... | ..... | 119 759 | 107 097 | 238 270 | (2) | (2) |
| United States | 54 976 | 55 368 | 65 345 | 47 620 | 35 834 | 4 733 | 7 970 | 1 975 | 2 014 | 602 |
| Australia | 3 | 22 | 13 | (2) | (2) | 2 579 | 3 233 | 2 160 | (2) | (2) |
| Japan | ..... | 13 284 | 16 121 | 8 676 | 1 735 | ..... | ..... | ..... | ..... | ..... |
| Norway | 2 883 | 2 767 | 1 506 | 2 529 | 446 | ..... | ..... | ..... | ..... | ..... |
| Sweden | 260 | 5 069 | 4 907 | 1 299 | ..... | 74 | 268 | 315 | 319 | ..... |

(1) 1st half-year. — (2) Figures not available. — (3) 10 months.

## FOREIGN TRADE IN VARIOUS MILLING RESIDUES (other than bran).

| Countries | Imports | | | | | Exports | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1911 | 1912 | 1913 | 1914 | 1915 | 1911 | 1912 | 1913 | 1914 | 1915 |
| | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons |
| Argentine: | | | | | | | | | | |
| Maize residues | ..... | ..... | ..... | ..... | ..... | 1 200 | 1 742 | 1 656 | 1 299 | ..... |
| Austria Hungary: | | | | | | | | | | |
| Mill feed | ..... | 12 | 2 | ..... | ..... | 411 | 780 | 1 148 | (1) 1 065 | (2) |
| United States: | | | | | | | | | | |
| Mill feed | ..... | ..... | ..... | ..... | ..... | ..... | 53 002 | 146 562 | 45 622 | 19 703 |
| Italy: | | | | | | | | | | |
| Wheat (hard) pollards (re-export) | ..... | ..... | ..... | ..... | ..... | 22 203 | 22 627 | 27 336 | 25 492 | (3) 1 423 |
| Netherlands: | | | | | | | | | | |
| Pollards | 18 193 | 16 509 | 20 616 | 8 755 | (2) | 9 767 | 12 956 | 13 098 | (2) | (2) |
| Mill feed (wheat, rye, buckwheat) | 289 029 | 281 621 | 311 066 | (2) | (2) | 84 023 | 95 532 | 106 819 | (2) | (2) |
| Switzerland: | | | | | | | | | | |
| Mill feed | 53 858 | 53 543 | 57 937 | 35 987 | (1) | 7 | 83 | 69 | 106 | (2) |
| Milling offals | 6 307 | 5 842 | 6 730 | 9 979 | (1) | 863 | 864 | 1 005 | 864 | (2) |

(1) 1st half-year. — (2) Figures not available. — (3) 10 months.

## Foreign trade in linseed cakes and meal.

| Countries | Imports | | | | | Exports | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1911 | 1912 | 1913 | 1914 | 1915 | 1911 | 1912 | 1913 | 1914 | 1915 |
| | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons |
| Austria Hungary | 1 791 | 3 882 | 4 989 | (1) 1 829 | (2) | 15 051 | 15 304 | 18 245 | (1) 11 900 | (2) |
| Denmark | 11 648 | 11 334 | 66 015 | (1) 60 210 | (2) | 59 | 272 | 147 | (2) | (2) |
| Spain | ..... | ..... | ..... | ..... | ..... | 1 161 | 1 412 | 759 | 418 | 519 |
| United States | ..... | ..... | ..... | ..... | ..... | 238 615 | 319 791 | 394 502 | 230 966 | ..... |
| United Kingdom | 52 819 | 55 135 | 83 679 | 47 555 | 66 647 | 2 554 | 4 977 | 5 551 | 3 796 | 96 |
| Netherlands | 198 337 | 261 099 | 275 122 | 220 849 | 216 624 | ..... | ..... | ..... | ..... | ..... |
| Russia | ..... | ..... | ..... | ..... | ..... | 149 239 | ..... | ..... | ..... | ..... |
| Sweden | ..... | 2 192 | 4 359 | 1 621 | ..... | ..... | 313 | 224 | ..... | ..... |

(1) 1st half-year. — (2) Figures not available.

## Foreign trade in cottonseed cakes and meal.

| Countries | Imports | | | | | Exports | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1911 | 1912 | 1913 | 1914 | 1915 | 1911 | 1912 | 1913 | 1914 | 1915 |
| | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons |
| Denmark | 172 842 | 242 856 | 232 555 | (1) 103 458 | (2) | ..... | ..... | ..... | ..... | ..... |
| United States | ..... | ..... | ..... | ..... | ..... | 467 872 | 543 470 | 455 893 | 285 355 | 661 539 |
| United Kingdom | ..... | ..... | 214 343 | 166 168 | 188 208 | ..... | ..... | 7 042 | 4 019 | 2 733 |
| Netherlands | 26 336 | 35 650 | 25 276 | 10 851 | 2 132 | ..... | ..... | ..... | ..... | ..... |
| Sweden | 4 211 | 17 804 | 9 485 | 13 080 | ..... | 21 | 172 | 1 704 | 1 | ..... |

(1) 1st half-year. — (2) Figures not available.

## FOREIGN TRADE IN VARIOUS FEEDING CAKES (unnamed, etc.).

| Countries | Imports | | | | | Exports | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1911 | 1912 | 1913 | 1914 | 1915 | 1911 | 1912 | 1913 | 1914 | 1915 |
| | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany | 756 772 | 794 190 | 828 492 | (1) 367 317 | (2) | 233 235 | 263 623 | 294 174 | (1) 171 319 | (2) |
| Argentine | ..... | ..... | ..... | ..... | ..... | 20 228 | 17 622 | 20 952 | 17 403 | 18 479 |
| Austria-Hungary | 56 352 | 42 602 | 32 219 | (1) 12 157 | (2) | 20 007 | 29 725 | 31 235 | (1) 16 884 | (2) |
| Belgium | 240 223 | 242 354 | 255 952 | (1) 116 514 | (2) | 79 042 | 71 423 | 56 810 | (1) 29 731 | (2) |
| China | 56 | 161 | 19 | 14 | ..... | 695 303 | 544 543 | 793 836 | 723 519 | ..... |
| Denmark | 313 340 | 269 019 | 287 305 | (1) 151 085 | (2) | 16 169 | 16 145 | 15 135 | (2) | (2) |
| Egypt | ..... | ..... | ..... | ..... | ..... | 85 173 | 80 778 | 62 977 | 79 987 | 111 670 |
| France | 142 795 | 154 968 | 101 573 | 72 711 | 3 785 | 222 764 | 213 690 | 214 801 | 179 917 | 111 079 |
| Algeria | 4 711 | 3 909 | 2 684 | 2 112 | 1 768 | ..... | ..... | ..... | ..... | ..... |
| United Kingdom | 77 681 | 45 381 | 78 288 | 89 546 | 118 798 | 99 609 | 60 293 | 35 867 | 29 894 | 26 232 |
| Australia | 693 | 458 | 146 | (2) | (2) | 57 | 40 | 32 | (2) | (2) |
| Ceylon | ..... | ..... | ..... | ..... | ..... | 3 055 | 2 575 | 3 704 | ..... | ..... |
| British India | ..... | 18 | 52 | 500 | 462 | 135 001 | 150 656 | 181 676 | 151 342 | 152 285 |
| Nigeria | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 4 910 | 1 254 | (2) |
| Union of South Africa | ..... | ..... | ..... | ..... | ..... | 126 | 2 136 | 2 810 | 963 | ..... |
| Italy | 5 385 | 3 913 | 2 957 | 1 121 | (3) 1 263 | 40 735 | 26 194 | 19 662 | 54 693 | (3) 3 724 |
| Japan | 1 658 760 | 610 489 | 744 093 | 2.167 626 | 830 831 | ..... | ..... | ..... | ..... | ..... |
| Norway | 28 782 | 29 665 | 30 122 | 37 668 | (3) 29 180 | 457 | 342 | 3 770 | 952 | (3) 607 |
| Netherlands | 67 150 | 76 451 | 47 283 | 21 510 | 26 933 | ..... | ..... | ..... | ..... | ..... |
| Dutch E. Indies | (2) | 221 | 693 | 707 | (2) | (2) | 4 028 | 4 952 | 4 427 | (2) |
| Russia | ..... | ..... | ..... | ..... | ..... | 509 508 | 556 161 | 731 200 | 424 400 | (4) 71 100 |
| Sweden | 154 636 | 154 853 | 145 416 | 108 895 | (1) 82 171 | 242 | ..... | 143 | 28 | ..... |
| Switzerland | 41 121 | 34 091 | 29 928 | 17 608 | ..... | 566 | 956 | 1 015 | 414 | ..... |

(1) 1st half-year. — (2) Figures not available. — (3) 10 months. — (4) 11 months.

## Foreign trade.

| Countries | Imports | | | | | Exports | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1911 | 1912 | 1913 | 1914 | 1915 | 1911 | 1912 | 1913 | 1914 | 1915 |
| | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany: | | | | | | | | | | |
| beet-slices | 9 271 | 51 500 | 25 819 | (1) 5 878 | (2) | 42 793 | 4 382 | 7 672 | (1) 1 704 | (2) |
| Austria-Hungary: | | | | | | | | | | |
| beet-slices | 14 147 | 13 367 | 11 277 | (1) 6 615 | (2) | 14 405 | 17 462 | 18 086 | (1) 413 | (2) |
| Denmark: | | | | | | | | | | |
| molasses | 7 | 13 | 9 | (2) | (2) | 4 865 | 84 | 197 | (2) | (2) |
| molasses feed | 1 478 | 2 552 | 938 | (2) | (2) | 4 407 | 4 622 | 4 261 | ..... | ..... |
| United States: | | | | | | | | | | |
| beet-pulp (year ending June 30) | 1 218 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| France: | | | | | | | | | | |
| dried beet pulp | 48 113 | 42 938 | 1 | 6 | 13 | 1 138 | 962 | 488 | 648 | 154 |
| British Guiana: | | | | | | | | | | |
| «molascuit» | ..... | ..... | ..... | ..... | ..... | 5 184 | 5 198 | 6 970 | (2) | (2) |
| Mauritius: | | | | | | | | | | |
| « molascuit» | ..... | ..... | ..... | ..... | ..... | 12 | 376 | 434 | (2) | (2) |
| Norway: | | | | | | | | | | |
| molasses | ..... | 5 958 | 6 704 | 7 987 | (3) 6 143 | ..... | ..... | ..... | ..... | ..... |
| Dutch E. Indies: | | | | | | | | | | |
| « molascuit » | ..... | ..... | ..... | ..... | ..... | (2) | 3 536 | 18 208 | 12 355 | (2) |
| Sweden: | | | | | | | | | | |
| molasses feed | 6 247 | 6 712 | 4 980 | 3 345 | ..... | 1 009 | 1 136 | ..... | 541 | ..... |

(1) 1st half-year. — (2) Figures not available. — (3) 10 months.

## Residues of Brewing and Allied Industries.

### BREWERS' OFFALS (Coombs, etc.).

| Countries | Imports | | | | | Exports | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1911 | 1912 | 1913 | 1914 | 1915 | 1911 | 1912 | 1913 | 1914 | 1915. |
| | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany | 154 966 | 146 528 | 157 256 | (1) 69 999 | (2) | ..... | ..... | ..... | ..... | ..... |
| Argentine | ..... | ..... | ..... | ..... | ..... | 1 856 | 894 | 297 | 1 462 | ..... |
| Austria Hungary | 1 730 | 2 538 | 2 194 | (1) 1 285 | (2) | 2 352 | 1 253 | 1 210 | (1) 408 | (2) |
| Denmark | 435 | 742 | 678 | (2) | (2) | 239 | 166 | 84 | (2) | (2) |
| United States | ..... | ..... | ..... | ..... | ..... | 78 900 | 72 987 | 81 925 | 29 697 | 2 256 |
| United Kingdom | 3 094 | 4 091 | 4 345 | (2) | (2) | 8 130 | 5 232 | 5 704 | (2) | (2) |
| Australia | 1 | 2 | 2 | (2) | (2) | 1 864 | 2 337 | 1 542 | (2) | (2) |
| Switzerland | 3 189 | 5 513 | 6 153 | 3 878 | (2) | 4 224 | 3 954 | 4 194 | 4 221 | (2) |

(1) 1st half-year. — (2) Figures not available.

### DISTILLERY AND STARCH RESIDUES, ETC. (Dried grains, etc.).

| Countries | Imports | | | | | Exports | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1911 | 1912 | 1913 | 1914 | 1915 | 1911 | 1912 | 1913 | 1914 | 1915 |
| | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons |
| Germany | 63 603 | 6 747 | 68 900 | (1) 29 267 | (2) | ..... | 3 044 | 5 178 | (1) 4 031 | (2) |
| Austria Hungary | 1 065 | 3 421 | 4 307 | (1) 2 000 | (2) | 997 | 325 | 239 | (1) 176 | (2) |
| Denmark (gluten) | 751 | 306 | 21 | (2) | (2) | ..... | ..... | ..... | ..... | ..... |
| United States (maize germ cakes and meal) | ..... | ..... | ..... | ..... | ..... | 36 737 | 32 530 | 33 556 | 22 253 | 14 124 |
| France | 55 972 | 42 743 | 5 862 | 31 213 | 67 055 | 31 324 | 41 460 | 8 913 | 19 733 | 26 463 |
| Sweden (maize milling offals) | 9 275 | 10 658 | 13 767 | 11 475 | (1) 18 758* | 4 224 | 3 954 | 4 194 | 4 221 | (1) 45* |

(1) 1st half-year. — (2) Figures not available. — * Other products included.

## Residues of Animal Origin.

| Countries | Imports | | | | | Exports | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1911 | 1912 | 1913 | 1914 | 1915 | 1911 | 1912 | 1913 | 1914 | 1915 |
| | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons | metric tons |
| Argentine: | | | | | | | | | | |
| meat meal..... | ..... | ..... | ..... | ..... | ..... | 2 262 | 3 374 | 2 744 | 1 701 | 101 |
| Denmark: | | | | | | | | | | |
| meat meal..... | 59 | 56 | 304 | (1) | (1) | ..... | ..... | ..... | ..... | ..... |
| Norway: | | | | | | | | | | |
| meat meal..... | ..... | ..... | ..... | ..... | ..... | 12 346 | 14 548 | 8 929 | 8 978 | [2])9 933 |

(1) Figures not available. — (2) 10 months.

## WHOLESALE PRICES OF CERTAIN FEEDING STUFFS.

Owing to the present condition of the international money market, the divergence between the value in francs at par and that actually quoted on the various markets is very marked. Consequently, in order to have comparable data we have converted the prices in francs at par to terms of gold francs. Considering the pound sterling as practically equivalent to gold, use has been made of the exchange on London. A list of quotations is given below; the conversion coefficients can then be calculated by dividing the rate at par by that obtaining on the particular date under consideration.

### Exchange on London at the end of each month.

(Value of the pound sterling relative to various currencies).

| Dates | United States | France | Italy |
|---|---|---|---|
| | Dollars. | Francs. | Lires. |
| (*Value of the pound sterling at par*) | (*4.86665*) | (*25.2214*) | (*25.2214*) |
| End January 1915 ..... | 4.85 1/2 | 25.11 1/4 | 26.90 |
| » February » ..... | 4.81 | 25.27 1/2 | 28.10 |
| » March » ..... | 4.80 | 25.45 | 27.55 |
| » April » ..... | 4.79 1/2 | 25.50 | 27.85 |
| » May » ..... | 4.78 3/4 | 25.92 1/2 | 27.62 1/2 |
| » June » ..... | 4.77 1/4 | 26.16 | 28.45 |
| » July » ..... | 4.76 7/8 | 26.50 | 30.27 1/2 |
| » August » ..... | 4.63 3/4 | 27.73 1/2 | 30.05 |
| » September » ..... | 4.70 3/4 | 27.60 | 29.60 |
| » October » ..... | 4.65 1/2 | 27.53 | 29.95 |
| » November » ..... | 4.70 | 27.78 | 30.55 |
| » December » ..... | 4.73 1/2 | 27.66 | 31.16 |

## Residues of Milling Industry.

SPOT PRICES FOR WHEAT BRAN (per 100 kilos).

| Date | Genoa | London | Minneapolis | Paris |
|---|---|---|---|---|
| | gold francs | gold francs | gold francs | gold francs |
| End January 1915..... | 18.28 | 16.13–17.06 | 13.17–13.45 | 15.57–16.07 |
| » February » ..... | 16.16 | 17.06–17.68 | 11.56–12.14 | 15.97–16.22 |
| » March » ..... | 18.31–18.52 | 16.44–16.75 | 12.17–12.45 | 14.62–15.11 |
| » April » ..... | 19.02 | 17.06–17.68 | 11.60–12.76 | 14.34–14.59 |
| » May » ..... | 18.26 | 14.89 | 11.03–11.62 | 11.43–11.67 |
| » June » ..... | 13.30 | 15.20–15.51 | 11.66–11.94 | 9.88–10.12 |
| » July » ..... | 13.75 | 15.20–15.82 | 12.25–12.53 | 10.23–10.47 |
| » August » ..... | 14.27 | 16.75–17.06 | 11.09–11.39 | 8.64–19.32 |
| » September » ..... | 14.06 | 16.44–16.75 | 10.48–10.63 | 11.42–11.88 |
| » October » ..... | 13.89 | 17.99–18.61 | 10.60–10.75 | 1.374–14.20 |
| » November » ..... | 16.27 | 20.47–21.22 | 10.64–10.95 | 16.12–16.34 |
| » December » ..... | 17.00 | 21.71–21.96 | 10.56–11.15 | 16.41–16.87 |

## Residues of Oil and other Industries.

SPOT PRICES FOR LINSEED CAKES (per 100 kilos).

| Date | Genoa | London | Marseilles | New York |
|---|---|---|---|---|
| | gold francs | gold francs | gold francs | gold francs |
| End January 1915..... | ..... | 26.99–27.30 | ..... | 22.90–23.48 |
| » February » ..... | ..... | 27.61–28.23 | ..... | 23.12–23.70 |
| » March » ..... | ..... | 25.44–26.06 | ..... | 18.83–19.11 |
| » April » ..... | ..... | 23.58–24.20 | ..... | 13.34 |
| » May » ..... | ..... | 24.82–25.44 | ..... | 15.67 |
| » June » ..... | ..... | 25.44 | ..... | 17.48–18.64 |
| » July » ..... | ..... | 27.92–28.54 | ..... | 20.40–20.90 |
| » August » ..... | ..... | 28.54–29.16 | 25.46 | 22.48–23.38 |
| » September » ..... | ..... | 28.54–28.85 | .26.27 | 21.85–22.44 |
| » October » ..... | ..... | 27.92–29.78 | 27.48 | 21.80–22.10 |
| » November » ..... | ..... | 30.09–30.71 | 29.05 | 23.66 |
| » December » ..... | ..... | 31.02–31.64 | 29.63 | 22.02–22.90 |

## Spot prices for cottonseed cakes (per 100 kilos).

| Date | London | New York (*f. o. b.* New Orleans) |
|---|---|---|
| | gold francs | gold francs |
| End January 1915 | 16.13 | 12.60 |
| » February » | 16.44–16.75 | 14.74 |
| » March » | 15.82 | 14.77 |
| » April » | 15.35–15.51 | ..... |
| » May » | 16.13–16.44 | ..... |
| » June » | 16.13 | 13.98 |
| » July » | 17.99 | ..... |
| » August » | 19.85 | ..... |
| » September » | 20.78 | 14.76–15.94 |
| » October » | 22.33 | 16.73–17.92 |
| » November » | 23.26–23.58 | 17.16 |
| » December » | 24.51–24.82 | 17.03 |

## Spot prices for ground-nut cakes (per 100 kilos).

| Date | Genoa | London | Marseilles |
|---|---|---|---|
| | gold francs | gold francs | gold francs |
| End January 1915 | ..... | 22.02 | ..... |
| » February » | ..... | ..... | ..... |
| » March » | ..... | ..... | ..... |
| » April » | ..... | ..... | ..... |
| » May » | ..... | ..... | ..... |
| » June » | ..... | 21.71 | ..... |
| » July » | ..... | 21.71 | 12.85 |
| » August » | ..... | 21.71–22.02 | 13.19 |
| » September » | 17.04–17.89 | 21 71 | 16.22 |
| » October » | 16 84–17.68 | 23.58 | 14.66 |
| » November » | 16.51–17.34 | 23.89 | 14.75 |
| » December » | 16.19–17.00 | 26.79 | 15.73 |

## Spot prices for copra cakes (per 100 kilos).

| Date | Genoa | London | Marseilles |
|---|---|---|---|
| | gold francs | gold francs | gold francs |
| End January 1915 | 20,63–21,10 | 18,92 | ..... |
| „ February „ | 19,52–19,97 | 18,92–19,23 | ..... |
| „ March „ | 19,91–20,37 | 17,37 | ..... |
| „ April „ | 19,70–20,15 | 16,75 | ..... |
| „ May „ | 19,86–20,77 | 16,75–17,37 | ..... |
| „ June „ | 19,28–19,72 | 17,99 | ..... |
| „ July „ | 16,25–17,08 | 19,23 | 11,42 |
| „ August „ | 16,37–17,21 | 19,85 | 14,10 |
| „ September „ | 16,62–17,47 | 20,47 | 15,53 |
| „ October „ | 16,42–17,26 | 21,40 | 15,57 |
| „ November „ | 16,51–16,92 | 22,33 | 15,43 |
| „ December „ | 16,59–17,00 | 24,30 | 18,01 |

## Spot prices for sesame cakes (per 100 kilos).

| Date | Genoa | Marseilles |
|---|---|---|
| | gold francs | gold francs |
| End January 1915 | 21.56–22.03 | ..... |
| „ February „ | 20.64–21.09 | ..... |
| „ March „ | 21.06–21.51 | ..... |
| „ April „ | 20.83–21.28 | ..... |
| „ May „ | 21.00–21.46 | ..... |
| „ June „ | 20.39–20.83 | ..... |
| „ July „ | 16.66–17.50 | 11.66 |
| „ August „ | 16.79–17.25 | 11.14 |
| „ September „ | 17.04–17.47 | 13.71 |
| „ October „ | 16.84–17.26 | 14.20 |
| „ November „ | 15.68–16.51 | 17.02 |
| „ December „ | 15.38–16.19 | 18.01 |

## SPOT PRICES FOR VARIOUS CAKES (per 100 kilos).

| Date | Palm kernel — London | Maize — New York |
|---|---|---|
| | gold francs | gold francs |
| End January 1915 | 17.06 | 16.04–16.61 |
| „ February „ | 17.37 | 20.24–20.81 |
| „ March „ | 16.44 | 17.38–17.96 |
| „ April „ | 15.51 | 12.76–13.91 |
| „ May „ | 14.89 | 12.78–13.94 |
| „ June „ | ..... | 12.82–13.98 |
| „ July „ | ..... | 12.83–13.99 |
| „ August „ | ..... | 17.08 |
| „ September „ | ..... | 16.83 |
| „ October „ | 17.37 | 17.02 |
| „ November „ | 19.23 | 16.86 |
| „ December „ | ..... | 16.73 |

## *Common Standards of Measurement for Chief Concentrates and their Metrical Equivalents.*

| Markets | Standard | Metrical equivalent |
|---|---|---|
| | | kg. |
| *Bran.* | | |
| Argentine | 100 kg. | ..... |
| Austria-Hungary | Zentner | 50 |
| United States | Long ton | 1 016 |
| | Short ton | 907.18 |
| France | 100 kg. | ..... |
| United Kingdom | Ton | 1 016 |
| Canada | Short ton | 907.18 |
| India | Bazaar maund | 37.251 |
| Union of S. Africa | Bag | 69.40 |
| Italy | Quintale | 100 |
| Russia | Poud | 16.38 |
| *Oil Cakes.* | | |
| Germany | Doppelzentner | 100 |
| China | Picoul | 60.479 |
| Egypt | Ardeb | 121.23 |
| United States | Long ton | 1 016 |
| | Short ton | 907.185 |
| France | 100 kg. | ..... |
| United Kingdom | Ton | 1 016 |
| Canada | Ton | 1 016 |
| India | Bazaar maund | 37.324 |
| Japan | 10 Kwan | 37.50 |
| Dutch Indies | 100 kg. | ..... |
| Russia | Poud | 16.38 |

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SECOND PART.

# ABSTRACTS

## AGRICULTURAL INTELLIGENCE

### GENERAL INFORMATION.

382 - **Oil of Citronella as a Preventive of Mosquito Bites.** — GIVEN D. H. C., in *The Journal of State Medicine*, Vol. XXIV, No. 2, pp. 47-51 + 2 figs. London, February 1916. RURAL HYGIENE

An account of the good results obtained by the use of oil of citronella (*Andropogon Nardus*) in protecting from mosquito bites the crew of a ship anchored at Hankow. About half a drachm or less in the palm of the hand is sufficient to anoint the feet, ankles, hands and face, and to render them immune for at least four hours, and often for the whole night. Citronella is very cheap if bought wholesale, athough sold at 6d. an ounce retail; 10 lbs. lasted practically the whole summer and was used by nearly everyone on board.

383 - **The First 50 Years of the Moscow Higher School of Agriculture.** — I. KATAEW, N. M., Academy of Petrowskoie. — The Agronomic Institute of Moscow; fifty years of existence (1865-1915) in *Selkskcie Khosiastwo i Liesowodstwo*, Year LXXV, No. 89, Vol. CCXLIX, pp. 333-367; Petrograd, Nov. 1915. — II. MOROSOW, G., Tribute to the Academy of Petrowskoie, in *Liensoj Journal*, Year XLV, No. 89, pp. 1-3, Petrograd, 1915. — III. BROUNST, W. The Academy of Petrowskoie. — The Agronomic Institute of Moscow, in *Zemledieltcheskaja Gazeta*, No. 47, pp. 1292-1924. Petrograd, November 21, 1915. — IV. PRIANICHNIKOW, D., Degrees in Science, *Ibid.*, pp. 1289-1292. — V. JAKOUCHKINE, J. W., The Chair of Agronomy at the Academy of Petrowskoie, in *Selskoie Khosiaistwo i Liesowodstwo*, Year LXXV, Vol. CCXLIX, pp. 368-378. Petrograd, Nov. 1915 AGRICULTURAL EDUCATIONS

The Higher School of Agriculture at Moscow is one of the oldest in Russia, the first of these institutions being founded in 1841 at Gori Gorkakh in the Government of Moghileff.

Its importance and the influence which it has continuously exercised in the country justify its claim to be a "National Institution" comparable with the National Agronomic Institute of Paris, the National School of

Agriculture at Grignon and the Higher School of Agriculture at Berlin. Its scientific organization and the continued adaptation of its teaching to modern necessities are exemplified by the modifications introduced in recent years in curricula and methods, which not only relate to higher agricultural training in Russia, but also bear upon the most importance educational problems now pressing for solution in almost every country.

The creation of the Higher School is due to the great reforms of the second half of the last century. It took place in 1865 at the time of the abolition of serfdom in Russia. The institution began its existence at the epoch of the great awakening of social energies, when agriculture and the conditions of rural Russia attracted the attention and activity both of the people and the Government. The new School thus became by a concourse of circumstances at this epoch the intellectual centre of rural Russia. Its foundation owed its initiative to the Agricultural Association of Moscow and it met with such favour in ruling circles that in 1861 a decree was signed installing the school on the historic estate of Petrowsko Rasoumowskoie, situated within a few miles of the ancient Capital. The estate cost some £ 27 000 ; it contained 714 desiatines (1 desiatine = 2 $^{3}/_{4}$ acres) of which 216 were under forest, 126 were arable lands, 68 under waste, 65 under vegetable and ordinary gardens, 22 occupied by lakes and the remaining 217 by roads, buildings etc.

Since its foundation, the Higher School has passed through four very different periods.

During the *first period*, from 1865 to 1873, it bore the name of "Academy of Agriculture" and its avowed object was to spread useful knowledge in relation to agriculture and forestry. It was open to all who desired instruction in these subjects, no diploma of secondary education being required for admission. During this period, out of 1111 students, only 158 held a diploma of higher or secondary education. The normal period of study was 3 years ; but students were allowed free choice of the course of study, were permitted to settle for themselves the time during which they wished to study ; and were not compelled to undergo any examination. Indeed, out of the 1111, only 82 went though the complete curriculum. It is an interesting fact that of those who did pass through the full term, 77 per cent devoted themselves afterwards to agriculture. So far the academy had accomplished its object.

It was during this first period that there were laid and afterwards developed the truly scientific foundations of higher agricultural education, based on a solid preparation in natural sciences during the first 2 years of study. The important courses in chemistry, physics, botany, plant physiology, anatomy, zoology, animal physiology, and agricultural chemistry, were organized by the leading professors of these sciences, who included some of the most eminent scientists. This tendency, far from being weakened, gradually gathered strength and still constitutes one of the best and most characteristic traditions of the Higher School at Moscow.

The *second period* lasted from 1873 to 1889. In the new statutes of 1873

the object of the academy was described as " scientific instruction in agriculture and forestry ". At the same time, the academy was transformed into a school of Agriculture of the higher class, *i. e.* it was provided with a fixed curriculum of studies obligatory on all students, with obligatory examinations. The length of the course of studies was 4 years and admission was confined to those students who possessed a qualification equivalent to that of secondary education institutions.

The positive element of the new statutes consisted in a better and more precise definition of the objects in view. Later on, there was a tendency to give instruction a more practical orientation. Thus, in 1883, the authorities required that, in the special agricultural courses, instruction in natural sciences should preponderate ; that experimental work should be increased ; that instruction should be more practical, the classes centering round the farm attached to the Academy itself. From the end of this year 1883, the students were required to carry out private farming work during the summer vacations. Later on, in 1889, admission to the academy was made conditional on an apprenticeship on a private agricultural undertaking.

The *third period* is the shortest and most unsettled in the School's existence. In 1889, the statutes were modified and the Academy of Agriculture and Forestry became one of Agriculture alone.

However, it became impossible to apply the new statutes to a great extent, since in 1890, in consequence of political agitation, admission to the Academy was prohibited by the Government and for a time the school ceased to exist.

The *fourth period* began in 1894 and still continues. Some months after its closure, the Higher School of Agriculture of Moscow was re-opened under the name of " The Agronomic Institute of Moscow ". The object of the Institute, according to the new statutes, consisted in higher agricultural education and in the teaching of agricultural hydraulics. This last was a considerable innovation. From the first years of its existence the Institute had endeavoured to accommodate itself to new requirements and had modified the instruction by enlarging the scope of existing courses, and introducing new courses of study. Thus, in 1913, a section of Ichthyology had been created with the object of serving as a basis for scientific instruction in fish-culture (which is of enormous importance in Russia) and of preparing specialists in this branch of work. This new department is thoroughly organized in all that concerns scientific material and teaching staff. There are 5 professors, besides 2 acting and 7 assistant professors.

The subjoined table, drawn up by Professor PRIANICHNIKOW, shows the great development of the Institute as regards the teaching of natural sciences and compares the number of professorships in the University Faculties of Natural Sciences with that in the Institute.

The above table shows that the Faculty of Natural Science (at the University) has only one chair of Agronomy while the Agronomic Institute in Moscow, although its instruction in natural sciences is almost the same, has a much larger number of professors of agronomy.

*Table showing Comparison between Number of Professorial Chairs in the University and in the Agronomic Institute of Moscow in Natural Sciences etc.*

| | Faculty of Natural Science in University | Agronomic Institute of Moscow | | | Difference |
|---|---|---|---|---|---|
| | Professors | Acting Professors | Assistant Professors | Total | |
| *Natural sciences.* Physics — Meteorology — Chemistry — Botany — Zoology — Mineralogy — Geology — Animal Physiology . . . . . | 11 | 10 | 3 | 13 | + 2 |
| *Agronomy I.* Agricultural Chemistry — Applied Geology — Plant Breeding — Sylviculture and other branches of plant cultivation. . . . . | 1 | 6 | — | 6 | + 5 |
| *Agronomy II.* Stockbreeding and allied branches. . . . . | 0 | 3 | 3 | 6 | + 6 |
| *Agronomy III.* Economic bases of agriculture . . . . . | 0 | 4 | 1 | 5 | + 5 |
| *Agricultural Machinery* . . . . . | 1 | 2 | — | 2 | + 1 |
| *Mathematical sciences.* Pure mechanics — Theoretical and applied mechanics — Descriptive Geometry — Astronomy — Surveying. . . . . | 7 | 5 | 1 | 6 | — 1 |
| *Rural Engineering.* Special course . . . | 0 | 6 | 1 | 7 | + 7 |
| Total . . . | 20 | 36 | 9 | 45 | + 25 |

With regard to details of the Institute's organization, the system of instruction and obligatory examinations at determined dates is now replaced by a system under which the student is permitted to choose the subject which he prefers to study. The methods of testing the knowledge acquired by students and their work are generally left to the initiative of the professors, who hold half-yearly examinations. The number of examinations for different groups of students depends on the section and qranch of instruction selected by them. The students themselves are left to decide in what order the practical experiments in the laboratories or science rooms, shall be conducted, and in what order the subjects of examination shall be taken etc.

In view of the great awakening of agricultural activity which has taken place in Russia during the last 10 years, the number of students has necessarily increased considerably. Whereas, formerly, the total number did not exceed 300, it now reaches 1500. Moreover, possess a diploma of higher education, *viz.* in 1914 there were 280 and in 1915 their number was 236.

The Institute received a new and very strong impetus in the last 7 years, during which M. A. W. KRIVOCHEINE was at the head of the Ministry of Agriculture. Thus, in 1912, the number of professorial chairs was doubled, so that while formerly there were only 21 professors and 16 assistants, there are now 39 professors, 9 acting professors, and 40 assistants. The staff expenses have risen from some £ 10 000 to over £ 23 000, while the expenditure on scientific material has increased from £ 4 000 to £ 6 000 per annum.

The law which empowered the Minister of Agriculture to open experiment stations at the higher schools of agriculture has contributed to the further scientific activity of the Institute. This law has permitted the addition to the Institute of a series of new experiment stations fully equipped and having in view not only educational objects but also scientific research of a general and local character. The following research stations are already at work: — Plant-breeding — Zootechny — Phytopathology — Agricultural Engineering. — Flax Culture. In a short time there are to be experimental stations for apiculture and horticulture. Each station has its own staff *viz.* one director with a good number of assistants.

Considerable grants are allowed to the experiment stations. Some are already fitted with a series of laboratories, museum collections etc. In 1915, over £ 10 000 was allotted to the stations. The former chairs of Agronomy and Zootechny are being similarily developed, with the creation of laboratories and the addition of a series of new professorial chairs.

Sometime ago, the Institute proposed to reconstruct the Forestry section, and the Minister of Agriculture proposed adding two new branches of activity to the Institute: *viz.* preparation of specialists: 1) for agricultural engineering: 2) for technical chemistry (manufacture of chemical manures). These 2 branches of instruction are of exceptional importance for Russia. Suffice it to say that there have been discovered, in the basin of the river Volga, beds containing some 500 million tons of phosphorites, and the use of chemical manures in the country is increasing yearly.

According to the figures furnished by Professor FORTUNATOW, there have been turned out from the higher school of Moscow in the 50 years of its existence, 2 792 agriculturists and foresters (the latter numbering 337) out of which number 1 179 have come from the Academy and 1613 from the Institute.

An interesting feature of the students life has been the growth of a splendid spirit of association. There are at the Institute many students' associations with very different aims and objects: 1) a relief fund to which deposits from old students may be also subscribed; 2) a student's Commission for the distribution of grants for study; 3) a reading club; 4) a library of works of general culture; 5) a publishing society; 6) a club of social agronomy with a library and a committee to which is entrusted the duty of distributing residential quarters in the "zemstwo"; 7) a fishing club; 8) a forestry club; 9) a horticultural club; 10) a teachers training club; 11) a photographic club, and so on. There are, moreover, district

societies of students which have for their aim the study of the economical and agricultural conditions of each district.

The agricultural school of Moscow has had a profound and beneficial influence and gained the esteem of all interested in the agricultural welfare of Russia. An esteem, says KATAEW, founded on the fact that the school has been practically an Agronomic University, always endeavouring to live up to its scientific mission, and taking as its basis a solid preparation in natural history ; counting among its professors some of the best scientists and striving to turn out students not only scientifically trained but also active agriculturists and good citizens.

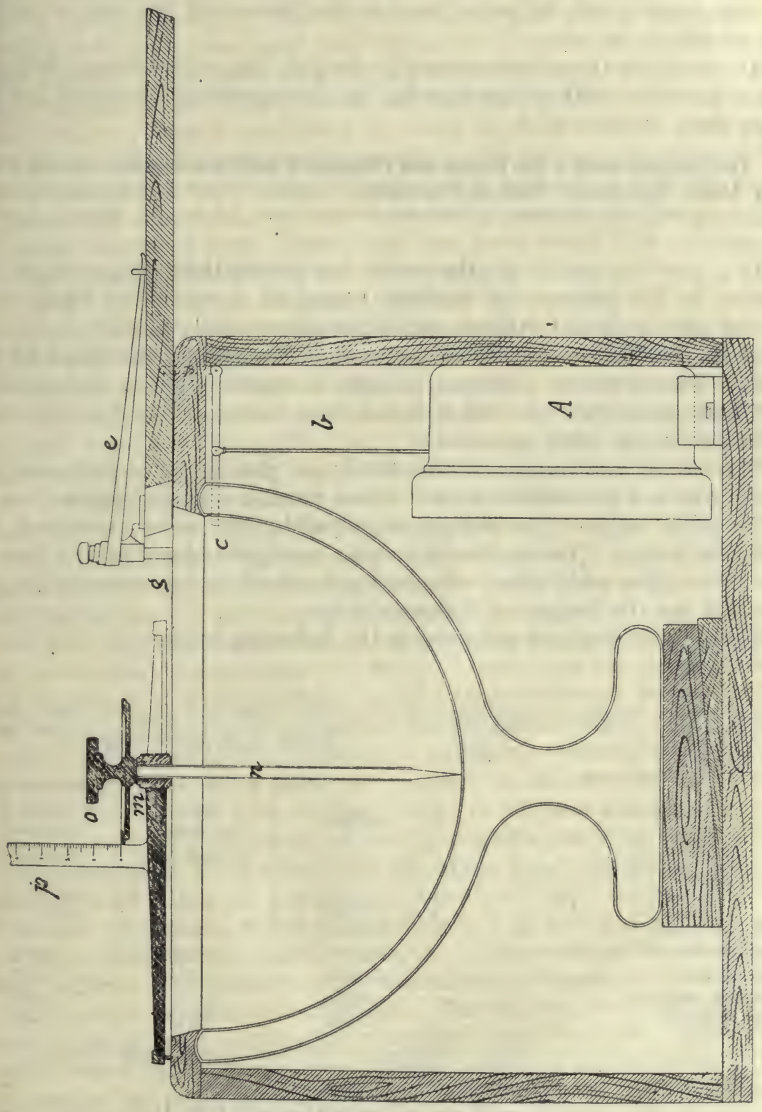
## CROPS AND CULTIVATION.

384 - **The "Eredia" Dewmeter** — EREDIA, F., in *L'Agricultura coloniale*, Year IX, No 12. pp. 705-714 + 4 fig. Florence, 1915.

AGRICULTURAL METEOROLOGY

This is a new apparatus for measuring the fall of dew, designed by Prof. EREDIA of the Central Bureau of Meteorology, Rome. Its component parts (shown in the figure) are as follows. A Dewar receiver in the shape of an open cup with a diameter of 11.28 cm, equal to a surface area of 100 $cm^2$ exposed to the atmosphere. The receiver is placed in a wooden box and supported on two pieces of wood which raise the cup into contact at its upper rim with the fixed annular covering of the wooden box. Fixed against the wall of the box is a clockwork action *A* which controls a striking mechanism, the spring being attached to a fixed rod *b*, whose upper end articulates with a lever having its fulcrum at *c*. The other end of the lever carries a pin which acts as a stop for a movable circular cover of wood, whose upper surface is pressed down by the end of the spring *e* which can move round the pivot *g* to which its end is attached. The apparatus works in the following manner : when exposed in the open air, in order to obtain a reading, the clockwork is wound up so that the spring (attached to the striking mechanism) is released exactly at sunrise ; as a result, the stop of the circular movable cover ceasing to act, this latter, pushed by the spring *e*, turns on the pivot *g* until it completely covers the opening of the Dewar cup, over which it fits exactly. In addition, the bevelled edge of the movable cover fits exactly into the annular cover of the box, closing it tightly and thus preventing evaporation of the dew collected at the bottom of the cup, in case the measurement is not carried out at once. To carry out the measurement, the Dewar cup is uncovered by turning the circular cover to its outermost position and a 3-armed fitting is placed on the fixed circular cover of the box and its extremities fitted into split metal sockets. The tripod carries the screw *m* whose milled head *o*, on turning, moves the micrometer screw ending in a point at its lower extremity. The circle round the head of the micrometer screw is divided into 50 equal parts and moves at a tangent to the millimetre scale *p*. One complete turn of the circle corresponds to one division of the scale and thus the movement of the screw can be measured to an approximate accuracy of 0.02 mm. Zero on the scale corresponds to the position where the point of the screw touches the bottom of the cup.

To obtain the amount of each fall of dew, the point of the screw is adjusted so as just to touch the surface of the water in the cup, an easy task,




"Eredia" Dewmeter — Vertical section.

as the screw has only to be made to coincide with its mirror image in the water.

The total number of millimetres through which the graduated circle has turned, and any fraction of a turn, indicate the depth of the water in the cup.

If *h* equal the depth, and R the radius of the sphere whose area is occupied by the water, the volume of water can by calculated from the formula $V = \pi h^2 (R - \frac{1}{3} h)$. To see if the measuring apparatus is properly set up turn the screw *n* till its point touches the bottom of the cup, when the scale should be at zero.

To avoid the above formula and to simplify the calculations, the apparatus is provided with tables showing the corresponding volume of dew fallen for each volume of *h*.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

385 – **The Displacement of the Potash and Phosphoric Acid Contained in Certain Rocks by Some Substances Used as Fertilizers.** — ANDRÉ G., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 162, No. 3, pp. 133-136. Paris, January 17 1916.

In a previous article (1) the writer has shown that the prolonged trituration, in the presence of distilled water, of a microcline felspar with different salts used as fertilisers and which are normally present in the soil, caused the liberation of a certain amount of the potash contained by the felspar. The nutritive solutions present in arable soil are derived from this double decomposition which is the more thorough the finer the state of division of the solid elements.

The writer has continued this study on glauconite (a hydrated silicate of iron and potassium) which varies considerably in composition according to its origin. The sample employed by the writer contained 7.08 per cent of potash. The samples of 10 gms. were ground and passed through sieve N° 70, after which they were well pulverised for 130 hours in the presence of 1 gm. by weight of different salts

The results obtained are given in the following table:

| Salts added in presence of water | Potash ($K_2O$) yielded to solution | | |
|---|---|---|---|
| | grammes | In 100 parts by weight of glauconite | As percentage of total weight contained in glauconite |
| None | 0.0230 | 0.23 | 3.24 |
| Calcium carbonate | 0.0402 | 0.40 | 5.67 |
| Sodium chloride | 0.0398 | 0.39 | 5.62 |
| Sodium nitrate | 0.0508 | 0.50 | 7.17 |
| Ammonium sulphate | 0.0706 | 0.70 | 9.97 |
| Calcium sulphate | 0.0394 | 0.39 | 5.56 |

Considerable quantities of potash were thus set free, the amounts being comparable to those obtained from microcline felspar. The sodium chloride and especially the nitrate of sodium, had a stronger action in liberat-

(1) See *B.* February 1914, No. 99 (*Ed.*)

ing the potash of the glauconite than upon that of the felspar. The same amount of felspar yielded, in the same time, only 3.25 and 3.21 per cent of the contained potash. The action of calcium carbonate is more marked upon glauconite than upon felspar. The potash liberated from the felspar by the same agent only amounted to 2.38 per cent of the total alkali content. The same may be said of the action of calcium sulphate. The maximum potash displacement was obtained in the presence of ammonium sulphate, when it amounted to nearly 10 per cent of the total potash. Ammonium sulphate had given a similar result in the case of the felspar, but the potash displaced was a little less (7.38 per cent). Thus the amount of the potash dissolved out from very finely ground glauconite is larger than that obtained from felspar, and the part which this mineral may play as a potassic fertiliser is far from negligible.

In order to put the conclusions derived by this method on a broader basis, attention was next paid to apatite. The object was to ascertain the amount of phosphoric acid capable of being removed by double decomposition when powdered apatite is ground in the presence of water with certain soluble salts used as fertilisers. Apatite is considered to represent a form of phosphoric acid which can only be assimilated by plants with great difficulty, on account of its crystalline structure, hardness, and very slight solubility under the conditions under which it occurs in the soil as a result of the disintegration of the primitive rocks.

Four experiments were made in each of which a powdered Ontario apatite (containing 39.33 per cent of phosphoric acid) was subjected to vigorous grinding for 134 hours in the presence of water and of 1 gm. by weight of the following substances : ammonium carbonate, sodium nitrate, potassium carbonate; these substances being chosen from the compounds met with in the soil. After grinding, the mixture was filtered, washed with distilled water and the filtrate examined for phosphoric acid. The result was negative in the case of the ammonium carbonate, although during grinding fresh additions were made of this salt, on account of its volatility. Negative results were also obtained with the nitrates although, according to certain workers, *precipitated* tricalcic phosphate should be slightly soluble in the presence of these salts. On the other hand, the potassium carbonate displaced a certain amount of phosphoric acid, 0.0139 gms. $P_2 O_5$ for 10 gms. of apatite, which corresponds to 0.35 per cent of the phosphoric acid present in the original material. This confirms the statement of many writers, who consider that potassium carbonate acts as a solvent of the tricalcic phosphate in the soil. The addition to farmyard manure of a certain quantity of tricalcic phosphate has often been considered advisable, since the ammonium carbonate produced by the fermentation of the manure has been regarded as capable of dissolving a small amount of this phosphate. The experiment here described shows that scarcely any tricalcic phosphate is thus dissolved, this is also in agreement with practical observation; the operation is consequently of little advantage to agriculture.

METHODS OF SOIL CULTIVATION

386 - **Improved Summer Fallowing.** — HITIER, H, in *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. II, Year 1916, No. 3. Paris, 1916.

M. HITIER reports upon a pamphlet by Count ALFRED DE POUCINS *La méthode de Culture JEAN*, which is the result of an enquiry ordered by the Union du Sud-est des syndicats agricoles on M. JEAN's method of farming which consists essentially in :

1. — Exclusive use of the cultivator or Canadian harrow, completely doing away with the plough.

2. — One-crop farming of cereals simply interrupted from time to time by a forage crop, thus obtaining extreme economy of equipment, reduction of teams and great saving of labour.

One bullock driver kept during the whole year and one for the period intervening between harvest and seeding time, together with some extra hands for threshing are all that are needed for 55 acres of cereals. M. JEAN at his estate of Bru, Commune of Cavanac near Carcassonne in the department of Aude, has successfully practised this system for the last 10 years.

As soon as the grain is cut and stooked, and before it is carted away, the stubbles are immediately worked over with a cultivator so as to stop all loss of moisture by capillarity and to favour the aeration of the soil, thus promoting microbiological activity. Riding cultivators fitted with 13 spring teeth and levers for regulating the depth of work are used ; the first time no great depth need be attained, it is sufficient just to loosen the surface and form a dust mulch which will diminish capillarity and absorb any rain or dew which may fall, thus rendering easier the next dressing with the cultivator which is given 10 or 15 days after the first, and, where possible, across it, with larger triangular blades if the flexible spring teeth are not strong enough.

Every 10 or 15 days the cultivator is drawn over the fields, till seeding time, each time increasing the depth of loosened soil by an inch or two. The soil being kept moist by the mulch will not demand much more power for the greater depths, while at the same time the whole field gets completely freed from weeds.

This system is especially recommended for regions in which a long period elapses within harvesting and sowing, such as the South-west and South of France.

MANURES AND MANURING

387 - **Green-Manuring in India** (1). — DOBBS A. C., in *Agricultural Research Institute, Pusa, Bulletin* No. 56, 55 pp., VI Plates, 1 Diagram. Calcutta, 1915.

The use of vegetation of all kinds for manure (usually leaves and twigs, collected and transported to the fields) when it could not be turned to any better account, has been perfectly familiar to Indian cultivators from time immemorial. Green-manuring (the turning in and burial of the green crop in the soil upon which it has grown), however, though not unknown in the country, has not been nearly so widely distributed as it should have been.

(1) See *B.* February 1916. No. 147.

The attention of the Agricultural Department has long been turned to this important question, and as early as 1882, experiments were made by them in green-manuring at Cawnpore, followed by others at Nagpur and Dumraon, while dating from 1905, field experiments were carried out in almost every Province of India. Important laboratory experiments were made in Madras, Assam, and at Pusa. The above-mentioned Bulletin is a compilation of all the reports relating to this work, and of articles appearing in other publications, and serves as a general report of the results hitherto obtained. It also gives a short sketch of the work which is being done in this direction at Pusa, and at some of the most important experiment stations of some provincial centres.

The question of green-manuring in India presents special difficulties, owing partly to the climate, and partly to the economic conditions obtaining there. The drought that prevails for half the year over the greater part of India is succeeded by the hot damp period of the monsoon. The length of the dry season prevents the formation of permanent pastures of Leguminosae and necessitates continual cultural operations, which as is well known, exhaust the organic matter of the soil. During the monsoon, a tropical luxuriance of vegetation is promoted which might be expected to redress the balance. That it does not do so, appears to be due principally to three causes :

1) The use for fuel (which is very scarce) of all spare organic matter, including cattle dung, and as much as is not required of the stems of such crops as occupy the ground for the whole of the monsoon season.

2) Insufficiency of rainfall in many districts, which precludes the profitable cultivation of both a full monsoon crop and a cold weather crop on the same land.

3) The growth, for food purposes, of crops like rice which yield a relatively small proportion of straw to grain, and while occupying the ground for only part of the monsoon, yet leave insufficient time, during the remainder, for a second crop to mature ; with the result that the ground is frequently left fallow or uncultivated.

In order for green-manuring to be advantageous, the crops used must not take the place of other crops of primary importance (forage, fuel) or interfere with the cultivation of main crops. The advantages of green-manuring depend, as a rule, upon the utilisation of a shorter or longer period of the monsoon during which the ground might otherwise be uncovered. Thus the various systems of green-manuring are conveniently classified according to the length of this period, that is, according to the time of sowing or planting the main crop for which the manuring is regarded as a preparation.

1) Main crop *rice*, transplanted usually about six weeks after the first monsoon showers.

2) Crops (like *tobacco* in Bihar) which are planted at the end of the monsoon, and the cultivation necessary for which precludes the maturing of a monsoon crop ; and valuable cold weather crops which require the con-

servation of a considerable part of the monsoon rainfall for the production of a full yield.

3) *Sugarcane, jute* and *garden crops* which are sown at the beginning of the hot season on un-irrigated land.

4) Other *crops grown on irrigated land* and which are thus to some extent independent of the monsoon.

*Rice.* — The most important recent development of green-manuring in India has been in connection with the rice crop. Experience has shown that the most economical way of growing rice and the method almost universally adopted in India, is to sow the seed in a seed bed and to transplant the seedlings in puddled land, when sufficient water has been accumulated. The interval between the first monsoon showers and the transplanting of the seedlings can be profitably utilised for the growth of a green manure crop. Under favourable conditions, the seed of the latter can be sown, even at the end of the preceding cold weather, and the young crop will survive the hot weather and be ready to take full advantage of the early part of the monsoon.

Plants which have been successfully used for green manure in the different provinces are : *Crotalaria juncea, Phaseolus Mungo, Dolichos biflorus, Sesbania biflorus, Sesbania aculeata, Tephrosia purpurea, Melilotus alba, Lathyrus sativus.*

*Tobaccos and valuable cold weather crops for un-irrigated Land.* — Green-manuring for these crops differs from that in practice in connection with rice, from the fact that the manure cannot be puddled in, and therefore requires a long time to rot ; on the other hand, there is a longer time available before the land is required. The green manure crop can be sown on the early rains in May and ploughed in as near July 15 as possible ; the tobacco being transplanted 8 weeks later. The following plants have been used with good success for green manure : *Crotalaria juncea, Vigna Catjang, Sesbania aculeata* etc.

*Jute, Sugar Cane and Garden Crops.* — The growth of a crop for green manure is out of the question on typical jute land, but in parts of the Rangpur, Pabna and Mymensingh districts, *Crotalaria juncea* is sown in October and ploughed in as green manure for the jute crop, though in many cases the stems and tops are removed for various purposes, and only the roots are left in the ground. As green manure for the sugar cane are chiefly used : *Tephrosia purpurea, Crotalaria juncea, Guizotia abyssinica* ; for betel, *Sesbania aculeata* ; for ginger, the leaves of nux-vomica (*Strychnos Nux-vomica*) and those of *Phyllanthus Emblica* ; for onions, garlic etc. *Crotalaria juncea.* In the Punjab, *Cyamopsis psoraloides* is used in addition to the latter plant.

*Irrigated Crops.* — The green-manuring crop (especially *Sesbania aculeata*) is grown during the warm season, while the principal crop is cultivated in the autumn-winter season.

388 – **Seeds and Plants imported into United States, 1913.** — In *U. S. Department of Agriculture, Bureau of Plant Industry, Inventory* No. 34, pp. 5-47, Plates I-VI, and No. 35 pp. 5-65, Plates I-VIII. Washington, September-November 1915.

These inventories published periodically by the Bureau of Plant Industry at Washington are intended to form a complete record of the thousands of new and more or less valuable plants introduced into the United States.

The dangers from the introduction of plant diseases and the great expense of this work to private firms led the United States Government to undertake the responsibility of this work which concerns the general welfare of the nation.

Descriptive and bibliographical notes are appended to the various introductions and where possible, cultural observations from the place of origin.

I. — Nos. 34 728 to 35 135. The explorer in charge draws special attention to the following plants introduced during January 1 to March 31, 1913.

Avocado pears (*Persea americana* Miller), from Mexico :

No. 34 855 from San Pablo, Campeche, a thin-skinned fruit with small seeds ; reputed to be of very superior quality.

No. 34 856 said to be the finest and largest fruits in Merida, a place noted for its fine avocados.

No. 34 831 from the Pincio gardens, Rome.

No. 35 121 from Caracas, Venezuela ; yellow skimmed variety of very fine flavour ; at altitudes of 1400 metres with low rainfall.

Bread-Nut tree (*Piratinera alicastrum.* Baillon)

No. 34876 from Merida, Mexico, branches used as fodder in dry season. Hardy ornamental shrubs suitable for the trying climates of the Great Plains.

*Acer — Corylus — Cotoneaster — Lonicera — Populus — Prunus — Tamarix* :

Nos. 34 784 — 34 805 from Novospassko, Russia.

Forage grasses :

No. 34 807. *Poa pallens*, resembling Kentucky blue grass, from Buenos Aires.

No. 34 818. *Eragrostis superba* Pyritsch from South Africa. One of the best native pasture grasses on the high veldt 35 00 to 5 500 feet ; common sandy soils in British Bechuanaland with rainfall not more than 10 inches.

Stevia rebaudiana (*Hemsley*) :

No. 34 883 from Paraguay ; herbaceous perennial, leaves containing a glycerin many times sweeter than sugar.

Papaya :

No. 34 777 from Merida, Mexico, very large fruits.

No. 34 903. fruits of enormous size on trees 7 feet high ; probably of value on account of high yield of papain.

Wild plum :

No. 34 851. *Prunus brigantina* from Nice, France.

No. 35 133. Chinese Yangtaw. *Actinidia chinensis*, female vine from Chelsea, London.

Persimmon: (*Diospyros kaki*) from Okitsu Japan:

No. 34 970. Fruit medium size, average weight $^1/_2$ lb., round and flattened; flesh firm, not very juicy, of very good quality after removal of astringency.

No. 34 971. Fruit medium large, more or less oblate; flesh fine, juicy, of very good quality when the astringency is removed.

No. 34 972. Fruit large, 1 lb or more, conical in form; flesh fine, tender, very juicy more or less astringent at first, but very sweet when soft, suited for dried fruit.

No. 34 974, from Hiroshima Japan. This variety produces the best dried persimmons in Japan.

"Sacred Ear Flower" (*Cymbopetatum penduliflorum* Baillon):

No. 35 039, Imported from Guatemala. Anonaceous plant dried flowers of which are used to flavour chocolate.

*Kerstingiella geocarpa*, Harms:

No. 34 916 — 34 919 from Togoland, Africa. An edible bean which matures its pods under ground like the ground nut.

"Olanamba" (undetermined):

No. 34 913, an edible root from Angola used in place of potatoes.

Kafir corn: *Holcus sorghum* L.

No. 34 911, from selected seed, with large white grains and drought resistant.

II. — Nos. 35 136 to 35 666, introduced between April 1st and June 30th 1913,

Chinese Hawthorn (*Crataegus pinnatifida*):

No. 35 456 from Tsiman, Shantung, China; a large fruited variety, hardy and drought resistant; fruit of good flavour and makes a unique preserve.

Wild Pear (*Pyrus ussuriensis*):

No. 35 304, from Harbin, Manchuria, probably the hardiest of the genus; fruits small and inedible; useful in breeding experiments.

Grape hybrid (*Vitis amurensis* × *V. riparia*):

No. 35 306, obtained by M. Mijurin, Kozlof, Tambof, Russia; fruits small and of good flavour.

Mountain Ash (*Sorbus aucuparia* L.):

No. 35 305, from same source as preceding: fruits pleasant and sweet.

Red currants (*Ribes* spp.):

Nos. 35 308 and 35 309, from Krasnoyarsk, Siberia; very hardy.

Hazlenut (*Corylus mandshurica*):

No. 35 288, Maxim from Harbin, Manchuria, very resistant to cold and drought. Shells very thick and hard; kernels small. Useful in breeding experiments.

Jujube (*Ziziphus jujuba* Miller):

No. 35 253 from Laoling, Shantung, China; seedless or with soft edible kernel; trees ringed or girdled to increase the crop.

No. 35 255 — 35 601. The scarlet jujube; fruits the size of small eggs.

No. 35 416. *Ziziphus trinervia* Poir, introduced as a stock for *Ziziphus jujuba* in the tropics.

Walnut (*Juglans regia sinensis*):

No. 35 610 to 35 613, 4 varieties from Shantung and Peking.

Muskmelons (*Cucumis melo* L.):

Nos. 35 645 to 35 657 from Laoling, Shantung, thirteen varieties of seed. Very susceptible to environmental changes. It is recommended that the first two fruits of selected plants should be kept for seed.

The "Che tree" (*Cudrania tricuspidata* (Carr.) Bureau):

No. 35 258 from Laoling, Shantung; a small shrub or tree, leaves used for feeding silkworms in time of scarcity. Similar to Osage orange; suitable as a hedge plant; fruit sweet and edible.

Potato (*Solanum tuberosum*):

Nos. 35 491 to 35 569–79 varieties from Chile and Peru, including several new forms and the celebrated yellow potato of Peru.

Papayas (*Carica papaya*):

Nos. 35 582 to 35 586 from the Belgian Congo and Nos. 35 142 and 35 143 (*Carica candamarcensis* Hooker.) from Nice, France; the mountain papaya.

Clover (*Trifolium* spp.):

Nos. 35 265 — 35 299 from Bogorodsky Experiment Field, Kursk, Russia, 15 species including *T. suaveolens, T. incarnatum, T. pratense, T. agrarium, T. arvense, T. elegans, T. alpestre, T. mountanium.*

Hedysarum spp.:

Nos. 35 444 to 35 448, five species received from Albano, Stockholm, including *H. altaicum, flavescens, hedysaroides, multijugum, alpinum.*

Fig (*Ficus ulmifolia*):

No. 35 449 from Los Banos, Philippine an edible form of the common Philippine figs, very sweet and palatable, suitable for moist, hot countries.

Mango (*Mangifera* spp.): from Buintenzorg, Java.

Nos. 35 403 to 35 412 including *M. foetida* Lour.

"Quandong-nut tree" (*Mida acuminata*):

No. 35 323 (*Mida acuminata*) from Sydney Australia.

Evergreen oak (*Pasania cornea* Oersted).

No. 35 320 (*Pasania cornea*. Oeersted) from Hongkong China; acorns edible.

Cotton varieties (*Gossypium*):

Nos. 35 315 — 35 317, from Southern Nigeria.

Sainfoin (*Onobrychis vulgaris*):

No. 35 313 from Siberia, suitable as late fodder in dry regions.

Alfalfa (*Medicago falcata*):

No. 35 311 from eastern Russia; 35 312 yellow flowered, improved, from Western Siberia.

Berna orange (Berna Late):

No. 35 247 from Algiers, very solid skin, exported from Murcia, Spain, during the summer.

Medjoul Date (*Phoenix dactylifera* L.):

No. 35 161 from Morocco.

Raspberry (*Rubus biflorus quinqueflorus* Foke):

No. 35 197 from Szechwan, China, golden yellow fruit of good flavour, stems of unusual vigour.

Tropical Melon (*Sicana odorifera*):

No. 35 136 from Tampico, Mexico; scented flesh makes excellent preserves.

389 – **Habitual Presence of a Micro-organism in the Roots of Crucifers.** — CAUDA A., in *l'Agricoltura Italiana*, Nos. 22-23-24, pp. 474-475. Pisa, Nov.-Dec. 1915.

The writer records the presence of a micro-organism peculiar to the Cruciferae, living habitually on the roots and observed by him on the roots of mustard, turnip and horse-radish. These micro-organisms occur particularly on the swellings which are often observed at the points where the secondary roots emerge. They are of the bacillary chain-form.

Further experiments will be necessary to determine whether this organism, which culture experiments have shown cannot be confounded with *Plasmodiophora*, has the faculty of fixing atmospheric nitrogen. So far, it has been demonstrated as belonging to the oligonitrophiles. The hypothesis which is founded on the supposed capability of Crucifers to fix atmospheric nitrogen and so explains their beneficial action as green manures, is therefore not devoid of foundation.

390 – **Variations in Mineral Composition of Sap, Leaves and Stems of the Wild-Grape Vine and Sugar-Maple Tree.** — SHEDD O. M. (Chemist, Kentucky Agricultural Experiment Station) in *Journal of Agricultural Research*, Vol. V, N° 12, pp. 529-541. Washington. D. C. December 20, 1915.

During the last three years, samples of the sap from the vine (*Vitis cordifolia*) have been collected and analysed to determine 1) whether the mineral composition of the sap varies in different parts of the vine at the same time ; 2) whether it varies during a single season in the same part of the vine ; and 3) whether it varies during different seasons.

The results of the analysis show that the water, calcium and sodium content of the sap are fairly constant when collected at two different points at the same time during the same year, while the silica, iron, aluminium, potassium, phosphorus and chlorine are the large variable constituents depending upon the time and point of collection. More organic matter is found in the sap at a point on the main branch 20 feet from the root than is found closer to the ground or on new branches. The silica, iron, aluminium, calcium, magnesium and sulphur however, are found in greater quantities in the new branches, thus showing that the minerals accumulate in the leaves. Certain constituents, *viz*: silica, iron, aluminium, magnesium and phosphorus, may be about the same in the sap when collected from two different parts at the same time, but vary widely when compared the following season. A further point of interest is that while the ratio of lime to magnesia is fairly constant for different parts of the same vine, that of potash to soda is variable.

Examination of the sap at different times of the year shows a concentration of minerals towards the end of the sap flow, or when new leaves develop, compared with the beginning of the new year. The order of magnitude of the variations in the various constituents is as follows: potassium, chlorine, iron, aluminium, silica, phosphorus, sulphur, magnesium, sodium and calcium.

Considerable variation in the mineral composition of the sap occurs at different periods of the day, an increase generally being found during the day and a more constant composition during the night.

The variations in the composition of the sap of the sugar-maple tree were also determined.

The mineral content of the sap was higher in 1914 than in 1913, the greatest variations being with the sulphur and phosphorus. Comparing the sap of the maple sugar with that of the water maple, large differences in the mineral constituents were found, and the large variations in the ratios of the lime to magnesia and potash to soda show that these differences are not due simply to the dilution of the sap by water in the soil.

391 – **The Effect of Heating Seeds upon the Development of the Plant; Experiments made in Russia with Wheat.** — Worobiew S. J., in *Khosiaistwo*. Year X, Nos. 47-48, pp. 1075-1083. Kieff, December 11, 1915.

The very limited number of observations regarding the action of different factors upon the plant previous to the vegetative period, induced the writer to undertake, at the Kieff Polytechnic Institute, experiments with the view of determining the effect of somewhat high temperatures, not upon the growing plant but upon the plant embryo. This heating can be compared to the artificial drying of the plant while still in an embryonic condition.

The experiments were carried out in pots with seeds of hard wheat (*Triticum durum*). In one set of pots the " Arnaoutka " variety was sown (the seed commonly used was taken in this case; this is a mixture of different varieties), while in the remainder were planted seeds of a pure line belonging to the " Koubanka " variety.

The amount of water given to the pots was: 60-40-20 per cent of the total amount required to saturate the soil. The seeds were subjected to heating for 20 minutes at a temperature of 80° C. The effect of heat upon the germination of the " Arnaoutka " seed may be summarised as follows: practically speaking, the germination capacity is not diminished (98 per cent as against 99 per cent), but in the case of the unheated seeds, the maximum germination (40 per cent) occurs on the fourth day, while in that of the heated seeds the maximum germination (37 per cent) is observed on the sixth day. The seeds used were from the harvest of the preceding year. Determinations of the germination capacity of grain harvested 2 years previously gave very different figures: that of the unheated seeds being 87 per cent, and that of the heated 63 per cent. The germination capacity of grain from a harvest spoilt by rain decreased still more, of the unheated seeds of such a crop, 70 per cent germinated and of the heated seeds 30 per cent. High temperatures, therefore, have a distinctly injurious effect upon

the embryos of old and spoilt grain, while they do no harm to grain harvested in normal weather.

The numerical results of these experiments are summarised in the appended table.

As regards the experiments with the variety " Arnaoutka ", this not being a pure line, the results are too variable for any definite conclusions to be drawn. This shows once more the necessity for using seeds from pure lines in experiments of this kind.

In the case of the pure line, on the contrary, the difference between the yield from similarly treated pots is very slight, never exceeding 40 per cent.

A tendency towards increased yield is observed in the case of wheat grown from heated seed, whatever may be the degree of the dampness of the soil. It is interesting to note that heating the seeds gave the best results where the soil received the smallest amount of water. Thus, with the same total yield (10.52 gms.) the pots sown with heated seed (Nos. 11-12) produced 7.12 gms. of grain, while the plants grown under similar conditions, but from unheated seed, produced only 6.37 gms. of grain. It is seen, on comparing other data, that heating increased the yield as follows: with 20 per cent of the total amount of water required for the saturation of the soil, 11.70 per cent ; with 40 per cent of this amount, 8.2 per cent ; with 60 per cent, 5.1 per cent. It results from these figures that, when the plants receive a large amount of water, heating the seed previous to sowing only increases the yield to an insignificant extent, and vice-versa.

It may be taken that this increase is due to the fact that plants derived from heated seeds, and which have grown without the necessary amount of water, undergo some kind of structural modification; they are lower, height only 710 mm. against 818 mm. for plants from unheated seed ; the leaves of the former weigh 27.6 per cent of the weight of the seed (pots Nos. 11 and 12), while those of the second weigh 32.9 per cent (pots Nos. 5 and 6). The plants grown from unheated seed, having more leaves, produce less seed (both as regards absolute weight and relatively to the weight of the seed) ; the assimilating apparatus of these plants, being less perfect would be less productive. In support of this hypothesis, a table is given embodying the results of research on leaf anatomy. These show that heating seeds occasions the formation of tissues with smaller cells : the length of the stomata and the dimensions of the mesophyll cells have lower values in the case of plants obtained from heated seed, and under conditions where soil humidity is 40 per cent and 20 per cent of total saturation ; great humidity of the soil (60 per cent), equalises the qualitative characteristics of the tissues.

The writer concludes that heating has a great stimulating effect upon the embryo and promotes in the plant a tendency to xerophytic structure ; this is shown in its reduced height, in the decrease in the relative weight of the leaves and in the dimensions of the cells. Seeing that xerophilous plants best withstand want of water, it can be considered that in places where water is abundant, heating the seed produces no modifica-

*Results Showing the Effect Produced Upon Plants by Heating the Seeds*

| | Nos. of pots | Height of plants in mm | Yield of grain and straw (grammes) | | | | | Weight of leaves in gms. | | Weight of leaves as percentage of weight of grain | | Amounts of water as percentage of total saturation of soil |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Grain | | Straw | Total | | | | | | |
| | | | per pot | average | | per pot | average | per pot | average | per pot | average | |
| A. – *Mixture of forms* (*Variety "Arnaoutka"*). | | | | | | | | | | | | |
| Unheated seed | 100 | 955 | 18.50 | 18.52 | 34.50 | 53.00 | 52.12 | 18.50 | 18.05 | 100.0 | 97.4 | 60 % |
| | 101 | | 18.55 | | 32.70 | 51.25 | | 17.60 | | 94.8 | | |
| | 102 | 911 | 13.00 | 15.00 | 24.10 | 37.10 | 41.55 | 12.10 | 13.30 | 93.0 | 89.2 | 40 % |
| | 103 | | 17.00 | | 29.00 | 46.00 | | 14.50 | | 85.3 | | |
| | 104 | 852 | 9.33 | 8.65 | 11.67 | 21.00 | 18.30 | 5.30 | 4.75 | 56 8 | 54.8 | 20 % |
| | 105 | | 7.97 | | 8.63 | 15.60 | | 4.20 | | 52.7 | | |
| Heated seed | 106 | 915 | 15.20 | 16.07 | 27.90 | 43.10 | 45.00 | 14.82 | 15.66 | 97.5 | 97.45 | 60 % |
| | 107 | | 16.93 | | 29.97 | 46.90 | | 16.50 | | 97.4 | | |
| | 108 | 855 | 14.62 | 13.94 | 27.00 | 41.62 | 37.68 | 13.00 | 12.00 | 89.0 | 86.0 | 40 % |
| | 109 | | 13.25 | | 20.50 | 33.75 | | 11.00 | | 83.0 | | |
| | 110 | 770 | 10.00 | 10.28 | 11.50 | 21.50 | 22.62 | 5.00 | 5.50 | 50.0 | 53.4 | 20 % |
| | 111 | | 10.55 | | 13.20 | 23.75 | | 6.00 | | 56.8 | | |
| B. – *Pure line* (*Variety Koubanka*). | | | | | | | | | | | | |
| Unheated seed | 1 | 985 | 19.57 | 19.85 | 30.00 | 49.57 | 49.35 | 14.50 | 14.50 | 74.0 | 73.0 | 60 % |
| | 2 | | 20.14 | | 29.00 | 49.14 | | 14.50 | | 72.0 | | |
| | 3 | 925 | 17.51 | 17.75 | 18.60 | 36.11 | 36.80 | 10.50 | 10.47 | 60.0 | 59.0 | 40 % |
| | 4 | | 18.00 | | 19.50 | 37.50 | | 10.44 | | 58.0 | | |
| | 5 | 818 | 6.25 | 6.37 | 4.10 | 10.35 | 10.52 | 2.10 | 2.10 | 33.6 | 32.9 | 20 % |
| | 6 | | 6.50 | | 4.19 | 10.69 | | 2.10 | | 32.3 | | |
| Heated seed | 7 | 1000 | 20.97 | 20.87 | 29.90 | 50.87 | 50.56 | 15.10 | 15.30 | 72.0 | 73.3 | 60 % |
| | 8 | | 20.77 | | 29.49 | 50.26 | | 15.50 | | 74.6 | | |
| | 9 | 950 | 19.05 | 19.20 | 20.10 | 39.15 | 39.50 | 10.20 | 10.50 | 53.5 | 54.7 | 40 % |
| | 10 | | 19.35 | | 20.50 | 39.85 | | 10.80 | | 55.8 | | |
| | 11 | 710 | 7.10 | 7.12 | 3.35 | 10.45 | 10.52 | 1.90 | 1.95 | 26.8 | 27.6 | 20 % |
| | 12 | | 7.14 | | 3.45 | 10.59 | | 2.00 | | 28.0 | | |

tion in the structure of the plant, while where water is somewhat scarce, heated seeds produce plants with modified structure for the purpose of enabling them to withstand drought.

392 – **Hourly Transpiration on Clear Days as Determined by Cyclic Environmental Factors.** — BRIGGS, L. J. and SHANTZ, H. L. (Biophysicist and Plant Physiologist, Bureau of Plant Industry) in *Journal of Agricultural Research*, Vol. V, No. 14, pp. 583-649, plates VIII-LV. Washington, D. C. January 3, 1916.

These transpiration experiments were carried out at Akron, Colorado, in 1912-1914, with a view to determining, as far as possible, the relative influence of various environmental factors on the transpiration of different plants. The plants, which included wheat, oats, rye, sorghum, alfalfa and amaranthus, were grown in large sealed pots of the type used in water requirement experiments (1). The environmental factors were recorded in terms of solar radiation, air temperature, depression of wet-bulb thermometer, evaporation from free water surface and wind velocity.

The transpiration curves of the various plants may be grouped into two classes: 1) those showing a flattening of the curve in the forenoon unaccompanied by corresponding changes in the environmental factors; and 2) those showing no such change. The cereals belong to the former group and the forage plants and amaranthus belong to the latter.

The change in the transpiration curve of the cereals appears to be due to some change in the plant resulting in a reduction in the transpiration rate below what would be expected from the form of the curve during the early hours of the morning. The hourly transpiration rate of the cereals on clear days increased steadily, though not uniformly, from sunrise to a maximum value which was reached between 2 and 4 p. m., after which it fell rapidly to the night level. The transpiration graphs for sorghum, alfalfa and amaranthus were somewhat more symmetrical with respect to midday, reaching their maximum between noon and 2 p. m., after which they fell approximately with the radiation.

During the night, transpiration at Akron is very low, being only 3 to 5 per cent of the transpiration during the day light hours. The radiation intensity rises in advance of the transpiration when the values are expressed as percentages of the maximum and falls either in advance of the transpiration, or with it, according to the plant considered. Radiation may therefore be looked upon as the primary causative factor in the cyclic changes.

The transpiration graphs usually rise and always fall in advance of air temperature.

Computation of the correlation coefficients between transpiration and the various environmental factors show the radiation, air temperature and wet-bulb depression to be correlated with transpiration approximately to the same degree, the figures being:

| | |
|---|---|
| radiation coefficient . . . . . | 0.82 to 0.89 |
| temperature » . . . . . | 0.77 to 0.86 |
| wet bulb depression coefficient . . . . . | 0.75 to 0.85 |

(1) See *B.* Jan. 1914 N° 20. (*Ed.*)

The squares of the coefficients indicate the amounts of transpiration determined by the several factors. Thus radiation determines the transpiration to the extent of from 0.67 to 0.77. The remainder 0.33 to 0.23 is ascribed to other factors and since the squares of the coefficients for these factors exceed this amount, it follows that these factors are also intercorrelated with the radiation. This conclusion is supported by the much lower correlation coefficients for temperature and wet-bulb depression obtained during the night when radiation is nil.

Though the observed and estimated evaporation rates are in satisfactory agreement this is not the case with transpiration, the value as estimated by the method of least squares being greater than that actually observed. This indicates that the plant undergoes changes during the day which modify its transpiration rate. These results therefore support the conclusions of other workers that plants under conditions favouring high evaporation do not respond wholly as free evaporating systems, even if amply supplied with water and no visible wilting occurs.

393 – **Carbohydrate Transformations in Sweet Potatoes** (1). — HASSELBRING HEINRICH and HAWKINS, L. A. (Plant Physiologists, Fermentation Investigations, Bureau of Plant Industry) in *Journal of Agricultural Research*, Vol. V, N. 13, pp. 543-560. Washington, D. C. December 27, 1915.

It has previously been noted that the sugar content of sweet potatoes remains comparatively low while they are in the ground, but that immediately after the roots are harvested, there is a transformation of starch into sugar which takes place more rapidly at that time than at subsequent periods. This sugar formation thus appears to be a phase of the carbohydrate metabolism of the sweet potato which is initiated under certain special conditions.

Experiments have therefore been carried out to investigate this process more fully. Determinations were made of the carbohydrate transformations taking place during a period of 10 or 12 days immediately after unearthing the potatoes and at a second subsequent period. The potatoes were kept at temperatures of 30°, 15.5° and 5° C.

The rate of starch conversion was found to vary with the temperature and at 15.5° to 30° the process soon approaches its maximum. The rate of accumulation of cane sugar varies with the temperature, being very rapid at 30° during the first 10 days, then rapidly diminishing. At 5°, little cane sugar is produced during the first 10 days, but the rate of accumulation subsequently increases rapidly. The formation of reducing sugar at 30° is sufficiently rapid to provide all that is used in respiration and allow a considerable accumulation, but less than that at 5°. At the lower temperature, there is a marked accumulation of reducing sugar at first which may be followed by a slight subsequent loss. The diminution in the production of reducing sugar during the second period at 5°, notwithstanding the continued conversion of starch, and the large increase in cane sugar during this period, suggests that the excess of reducing sugar is converted into cane

(1) See *B.* March 1916, N. 282. (*Ed.*).

sugar. Also, the concentration of reducing sugar always remains comparatively low, even at low temperatures when respiration is reduced to a minimum. It appears therefore, that with the exception of the quantity used for respiration, the reducing sugar is transformed into cane sugar as fast as it is formed from starch. Probably the series of reactions is reversible and the final equilibrium between the starch, reducing sugar and cane sugar depends on the temperature, with the effect that at low temperatures the system permits a greater concentration of sugar than at higher temperatures. This would also account for the rapid transformation immediately after lifting the roots.

The initiation of this transformation coincides with the cessation of the flow of reserve materials from the leaves and occurs in potatoes left in the ground after the haulm has been cut. It is therefore concluded that the activity of the haulm inhibits the conversion of starch to sugar in the growing sweet potato.

PLANT BREEDING

394 - **Inheritance of Length of Pod in Certain Crosses.** — BELLING JOHN (Assistant Botanist, Florida Agricultural Experiment Station) in *Journal of Agricultural Research*, Vol. V, N° 10, pp. 405-420. Washington, D. C., December 6, 1915.

The Florida velvet bean (*Stizolobium deeringianum*) and the Lyon bean (*S. niveum*) have one main genetic difference affecting pod length and this genetic difference segregates in genetic fashion. It is completely dominant and acts as a multiplier with a value of about 1.52. There are also minor factors for pod length which also act as multipliers with a combined multiplying value (when double) of about 1.42.

395 - **New Varieties of Plants on Sale by Vilmorin-Andrieux, Paris.** — GAUDOT C., in *Journal d'Agriculture pratique*. Year 80, No. 2, pp. 32-33, 3 figs. Paris, January 27, 1916.

Among the new varieties of plants for cultivation placed on the market by VILMORIN-ANDRIEUX of Paris, the writer draws special attention to the three following :

1) *Very early black hybrid oat.* This interesting spring variety was obtained some 10 years ago at Verrières by crossing the Australian with the Joanette oat ; it has recently been subjected to rigorous selection and is now well fixed. Height 3 to 4 feet, according to conditions of cultivation. It is vigorous and stools well. The panicles are well furnished ; the spikelets contain 2 or 3 grains, slightly bearded. When sown at the beginning of March, it comes into ear early in June and ripens about the 20th of July, *i. e.* 8-10 days before the earliest varieties. It thus unites three qualities : extreme precocity, abundant yield, resistance to rust and to lodging.

2) *Jerusalem artichoke*, obtained in the Verrière experiment. A robust variety doing well in poor soils, except in those which are impermeable or too wet. The tubers, which are tinged with rose and regular fusiform in shape, do not freeze in the ground and so can remain and be lifted as required. They can be used as food for man or beast.

3) *Chicory* (Chicorée à café). A vigorous plant, leaf entire, roots somewhat flattened, very regular in shape, 10 to 12 inches in length, high

proportion of dry matter and very pure, thanks to the high content of carbohydrates and slight quantity of inorganic matter. It offers the double advantage of a high yield and small fuel requirement for preparation.

396 – **Plant Breeding in Cuba.** — EARLE F. S. and POPENOE WILSON, in *The Journal of Heredity*, Vol. VI, N. 12 pp. 558-568, 6 figs, Washington, December 1915.

Plant breeding in Cuba was begun in 1901, the year in which one of the writers, was called to the island to organise the Government Agricultural Experiment Station at Santiago de las Vegas.

Naturally enough, the most important cultures were the first to receive attention. The testing of seedling sugar canes has been carried on for the past ten or twelve years at the Harvard Experiment Station, at Soledad, near Cienfuegos. As the soils of the Soledad district do not give satisfactory results with chemical fertilisers, and stable manure is out of the question, the problem to be solved was the production of a sugarcane giving a good yield even in exhausted soil. A satisfactory solution has been attained. In addition to the production of seedling canes which will maintain a profitable yield on poor soils, an effort has been made to obtain by means of selection, strains which will be resistant to root rot, a disease supposed to be caused by *Marasmius sacchari*. On virgin timber lands in Cuba, canes will often continue to give profitable results for twenty or twenty-five years without replanting ; after this the plants die out, and must be replanted every third or fourth year. The cane usually begins to die at certain spots in the field where the growth is weakest and the disease spreads in concentric circles. Always, however, occasional stools survive in these diseased areas : an attempt has been made to obtain from these, by selection, some immune strains of the " Cristalina " cane, which is so satisfactory in Cuba from most other points of view. Unfortunately, the work was dropped before any results were obtained, but the question is one that promises to yield most valuable results.

Cuba offers a large field of work for the selection of tropical fruits. At present, these is no vine suited to hot climates, though some south European varieties are occasionally grown in Cuba with some degree of success and there is a native species, *Vitis caribaea* which, even in a wild state, produces juicy fine grapes about 3/8 in. in diameter, dark purple in colour, and might through hybridisation with some of the cultivated grapes give rise to a race which would be of the greatest value to tropical regions. Further, from its productiveness and vigour (this vine sometimes covers trees 18 or 20 ft high) it would form an excellent stock for grafting.

In the mountains of Cuba, there is a walnut tree, *Juglans insularis*, producing nuts which compare favourably in size with the northern black walnut. The kernels are, however, difficult to remove from the shell and the partitions are thick. Through selection, this tree might be considerably improved and might be also of great value as a stock on which to graft cultivated walnuts (for there are very few nuts that succeed in the tropics). The Queensland Nut, *Macadamia ternifolia*, which has been introduced at Santiago de las Vegas has succeeded very well.

In all parts of Cuba, the mango is one of the most abundant of fruits.

There are two distinct races, *mango* and *manga*. The former is a tall, erect tree sometimes 60 ft. high ; its fruit is beaked at the apex and the fibre surrounding the seed is long and coarse. The *manga* is a low spreading tree, 35 or 40 ft. high, with more abundant but finer fibre. Two principal types of the *manga* race are distinguished and these are called, from the colour of the flesh of the fruit, the *manga amarilla* (yellow) and the *manga blanca* (white). There are also other races and types of mangos, the *Filipino*, with very little fibre and of excellent flavour ; the *Chino* and *manga mamey* of Cienfuegos and the *Biscochueto* of Santiago de Cuba ; the 3 last are very limited in distribution, but very superior in quality. The most important work in mango improvement yet done in Cuba consists in the selection and propagation of some of these superior types. The mango seed reproduces the type perfectly.

In order to improve the *avocado* (*Persea gratissima*), budded stocks of selected varieties have been imported to Cuba from Florida. In Cuba, a few selections have been made, but the work is only just beginning. The most important point in the selection of varieties is lateness of ripening ; and throughout the island are found occasional seedling trees which hold their fruit all the winter.

For the improvement of the *anón* (*Anona squamosa*) the writers advise crossing *Anona Cherimolia* with *A. squamosa* and *A. muricata*.

In Cuba, citrous fruits were formerly grown almost exclusively from seed. The Government Experiment Station at Santiago de las Vegas began the work of searching out and propagating desirable seedlings which are found growing half wild in neglected gardens and hedgerows.

Many of the most important tropical vegetables grown in Cuba (*Dioscorea Batatas, D. sativa, D. aculeata, Colocasia,* and *Manihot utilissima*) are propagated asexually ; the opportunity for selection is not lacking, however, since bud variation is much more common in the tropics than in temperate regions. Dr. JUAN T. ROIG has collected over 80 varieties of sweet potatoes from different parts of the island, and is now determining the comparative value of each.

During the early years of the Agricultural Station at Santiago de las Vegas, a great member of varieties of maize from all parts of the United States and Mexico were tested, but none proved to be well adapted to Cuban conditions. The common variety cultivated in the island was originally of a yellow flint type ; the ears are unusually heavily protected with husks that completely close at the tip, and the husks, leaves and stalks are tomentose ; this seems to protect the young leaves from the attacks of numerous small insects which are always seen working about them. The heavy husks protect the ears from the attacks of the corn weevil until the next planting season. The absence of glabrous varieties is apparently due to the work of small insects. Some of the dent maize imported into Cuba has occasionally been planted and has fertilised plants of the native variety, giving rise to acclimatised hybrids. At the Santiago Experiment Station, they have begun to select the best of these, in the hope of fixing a type with long ears enclosed in heavy husks.

397 – **Testing of Agricultural Seeds in South Australia.** — ANDREW K. W., in *The Journal of the Department of Agriculture of South Australia*, Vol. XIX, No. 3, pp. 279-283. Adelaide, October 1915.

Under the Federal Quarantine Act, the introduction into the Commonwealth of seeds or plants of over 140 species of noxious weeds is absolutely prohibited. Under the Federal Commerce Act, seeds imported must be true to name, and sound, fresh and clean, although no standard has so far been set up and discretion is allowed the customs as to what constitutes quality in this respect.

In the case of South Australia, samples of all agricultural seeds imported from abroad are taken at Port Adelaide, the Outer Harbour and the General Post Office Adelaide, by officers of this Department acting as Quarantine officers for plants, and submitted to another officer in this office who examines them to see what weed seeds they contain, and the quality of the consignment is gauged after germination tests have been made. Where any doubt exists as to whether they are suitable seeds to admit into the State, the Chief Quarantine officer for Plants for South Australia exercises powers conferred upon him under these Acts, and issues instructions for the goods to be freed (where practicable) of impurities, or to be destroyed, or returned, to the country of origin.

The results of purity tests are not given (as in most seed laboratories) in the percentage of impurities, but the method adopted is the same as that practised in Canada ; the number of weeds per unit weight of sample being given.

The germination tests are made in duplicate (two lots of 100 seeds each).

398 – **Experiments on the Germination of Seeds of Gramineæ.** — KLING, FRIEDRICH in *Journal für Landwirtschaft*, Vol. 63, No. 4, pp. 285-343. Berlin, February 14, 1916.

Experiments on 14 species of grasses to determine the optimum conditions for germination.

In order to study the influence of temperature on germination, the seeds were kept in darkness and exposed to constant temperatures (either 20° or 30° C.) and also to temperatures varying during the course of germination from 20° to 30° C.

In order to study the influence of light (at a constant temperature of 20° C.) the seeds were placed in a thermostat, one of the sides of which was of glass. The experiments all being made in winter, the influence of the direct sunlight was only of secondary importance, but the value of the results is not diminished thereby.

The seeds were placed either on or between moist blotting paper, or in flat porous earthenware dishes saturated with water. The water was renewed every two days, to replace that lost by evaporation.

For each species, 4 lots of 100 seeds were taken, except in the case of *Poa pratensis* and *Alopecurus pratensis*, where it is difficult to distinguish between good and bad seeds, consequently for these two species a given weight of seeds was employed. Althogether some 45 000 seeds were tested.

The following were shown to be the optimum conditions :

| Species | Medium and conditions of germination | Temperature | Date on which maximum number of seed germinated | Date after which seeds no longe germinated |
|---|---|---|---|---|
| *Phleum pratense* . . . | Between blotting paper in presence of light | Constant, 20°C | 4th day | 10th day |
| *Dactytis glomerata* . . | Between blotting paper | Variable, 20-30°C | 5th » | 14th » |
| *Avena elatior* . . . . | *do.* | *do.* | 1st » | — |
| *Holcus lanatus*. . . . | *do.* | *do.* | 9th » | 21st » |
| *Cynosurus cristatus* . . | On blotting paper in presence of light | Constant, 20°C | 10th » | 28th » |
| *Bromus mollis* . . . . | Between blotting paper in presence of light | *do.* | 5th » | 14th » |
| *Agrostis stolonifera*. . | On blotting paper in presence of light | *do.* | 4th » | *do.* |
| *Lolium italicum* . . . | Earthenware dishes in presence of light | *do.* | 5th » | *ao.* |
| *Lolium perenne* . . . | Between blotting paper or in earthenware dishes. | *do.* | *do.* | *do.* |
| *Anthoxanthum odoratum*. . . . . | Between blotting paper | Variable, 20-30°C | 7th » | 21st » |
| *Alopecurus pratensis* . | *a*) On blotting paper in presence of light | Constant, 20°C | 7th » | 21st » |
| | *b*) Between blotting paper | Variable, 20-30°C | | |
| *Festuca pratensis*. . . | *a*) Earthenware dishes | Constant, 20°C | 4th » | 14th » |
| | *b*) Between blotting paper | Variable, 20-30°C | | |
| *Festuca ovina* . . . . | On blotting paper in presence of light | Constant, 20°C | 7th » | 21st » |
| *Poa pratensis* . . . . | Earthenware dishes in presence of light. | *do.* | 10th » | 28th » |

The results are compared with those of other workers, and the following conclusions drawn :

1) Blotting paper is the best medium for the germination of most Gramineæ.

2) Contrary to the opinion of NOBBE, light is absolutely indispensable to the germination of certain species.

3) A change of temperature from 20° to 30° C. (20° for 18 hours and 30° for 6 hours) has proved favourable in many cases.

4) A constant temperature of 20° C., with absence of light is favourable to very few species.

5) A constant temperature of 30° C. is unfavourable to most species.

In the of case several species, the germinating faculty should be studied under different sets of conditions.

399 - **" Lencino " Rice in Italy.** — NOVELLI N., in *L'Italia agricola*, Year 53. No. 1, p. 17. CEREAL AND PULSE CROPS

This rice had a more important position in Italy before the introduction of " Chinese ordinario " but it has still a considerable importance in certain regions, Mantua, Venice etc. It does not do well in all soils, requiring rather deep lands, very little permeable, rich and somewhat clayey. But in favourable conditions it gives excellent returns.

Although now cultivated for a considerable time, it has not degenerated much and retains its primitive character fairly well.

It is vigorous in habit, fairly tall, stools well, and has fine panicles of great length; high yield. It is very resistant to disease but liable to lodging. Ripens somewhate late but with selection, a sub-race has proved earlier.

It is a " hard " variety, *i. e.* very resistant to hail, or to loss of grains at reaping time. It consequently requires vigorous threshing. It is much appreciated in commerce because it is easily glazed and has a fairly transparent grain. It is a kind deserving notice as it can probably be improved further by proper selection.

400 - **The Milling of Rice and its Effect upon the Grain.** — See No. 444 of this *Bulletin*.

401 - **The Cultivation of Cotton in Greece.** — *Agricultural Bulletin of the Royal Society of Agriculture in Greece*, VIIth Year, No. 9, pp. 189-191. Athens, 1915. FIBRE CROPS

The following is an abstract of an analytical study of different types of cotton: indigenous, American, and Egyptian, grown at the Experimental Station of Serres (Macedonia).

Egyptian cottons did not prove satisfactory, turning out far from pure, giving much waste, and a weak fibre. Its culture is to 12 to 15 per cent less than that grown in Egypt, with a loss in ginning 50 to 70 per cent more than average.

The " Chindako " is better, having a greater purity, but is 15 to 20 per cent inferior to the Egyptian Affihoun.

The American varieties " Cleveland Big Boll " and " Russels Big Boll " exceed all others in outturn and strength of fibre.

Other American varieties named by the writer are of similar value, equal to that of American middling.

The general conclusion is unfavourable to Egyptian cottons, but offers hope that, with suitable cultivation, cottons of commercial value can be acclimatized in Macedonia.

402 - **Cotton Hybridisation at the Botanic Gardens, British Guiana.** — HARRISON, J. B. and BANCROFT, C. K. in *The Journal of the Board of Agriculture of British Guiana*, Vol. VIII, No. 4, pp. 143-150. Demerara, September 1915.

Numerous experiments made since 1902 on the cultivation of Sea Island cotton demonstrated that owing to the unsuitability of the heavy soil and the meteorological conditions, this crop is unsuitable for the coastal region

of Guiana. The most favourable season produced a crop of only 268 lbs. of seed cotton per acre. Some promising results were at first obtained by seed selection of Egyptian cottons, but it was evident, as the result of the various trials, that the different varieties would not yield lint in sufficient quantity to enable them to be grown at a profit. All the varieties tried, except the Buck, were found to be very susceptible to the diseases prevalent among cotton plants, more especially to anthracnose and to cotton boll rot.

As the result of these trials, efforts were directed towards raising hybrids between the Sea Island and the native Buck cotton, with the object of combining the vigour and perennial habit of the latter with the quality of the lint of the former. These crosses have been bred to the 4th generation, from which 24 plants have been finally selected for the development of new strains.

Ten of these strains and specimens of two hybrids have been submitted to the Imperial Institute for valuation and report. This report states that the object of the experiments has been attained and it will be interesting to learn how the yields and hardness of these long-stapled hybrids compare with those of the indigenous Buck variety.

The brokers' valuation of the lint from the different hybrid cottons varied from 11d. to 14d per lb. with the best Barbados Sea Island at 14 ½ d.

403 – **Steps Taken to Preserve *Kokia Rocki*, a Wild Relative of the Cultivated Cotton Plant in Hawaii.** — YOUNG ROBERT A. (Office of Foreign Seed and Plant Introduction, Bureau of Plant Industry) in *The Journal of Heredity*, Vol. VII, No. 1, pp. 24-28 + 2 figs. Washington, January 1916.

The rise of the science of genetics has given breeders a keen realisation of the value of the wild relatives of important cultivated plants, although the former may be of no economic importance. This is the case with regard to a tree growing wild on Hawaii, and called " kokio " by the natives, *Gossypium drynarioides* by SEEMAN, and *Kokia Rocki* by LEWTON. This tree was threatened with absolute extinction and was only saved by the exertions of the Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture. The writer states that about 80 per cent of the native flora of the Hawaiian Islands is endemic and therefore it is of the greatest importance that these species should be preserved. Some " kokio " trees were found at Punwaawaa, in the island of Hawaii, on a bed of lava at a height of about 2700 ft. The average annual rainfall is 29 in. or less.

*Gossypium drynarioides* reaches a height of from 12 to 25 ft; it produces large brick-red flowers, each of which gives rise to a seed boll containing several seeds covered with short reddish hair. The natives do not use the cotton, but strip the trees of their bark which they use for dyeing fish nets ; the colour of the sap is reddish and is waterproof.

CROPS YIELDING OILS, DYES AND TANNINS

404 – **A Promising Coconut Clearing in Malaya.** — BROWN L. C. (Late Inspector of Coconuts, F. M. S.) in *The Agricultural Bulletin of the Federated Malay States*, Vol. III, No 12, pp. 445-446. Kuala Lumpur, September 1915.

The following is a brief history of some seed coconuts planted on an estate in Malaya in 1912.

60.000 nuts were purchased at a price of £7-12 *s.*; half of them were

set in the nursery in May and the other half in June. The number germinated was 53 000 or 88 per cent. The seedlings were planted out from November 26, 1912 to January 31, 1913, on 1104 acres of a free clay loam containing little sand. At the time of planting, the shoots were from 8 to 18 inches long and at the end of the first year averaged about 12 feet. The first wood at the base was formed at the age of 1 year 10 months and the first flowering spikes and buds appeared at 2 years and 5 months. The growth of the trees was very even and the average height at this stage was 26 feet and average girth 72 inches. The height of the wood at the base was 18 inches and the greatest number of rings (leaf scars) was 12. At the age of 3 years, the size of the largest nuts was 4 inches long.

Thus, these coconut palms came into flower in the record time of 2 ½ years from the time of planting the seedlings and bore nuts at the age of three years.

The writer attributes this remarkable growth to the care taken during the critical period in the life of the palms, *viz*: from germination to the 3rd year, and particularly at the time of planting out.

405 – **Production of Manna by Olive Trees in Algeria.** — BATTANDIER J. A., in *Journal de Pharmacie et Chimie*, No. 4, p. 105. Paris, February 16, 1916.

In 1901 an abundant production of manna by olive trees was recorded by the present writer. This rare phenomenon was again observed, towards the end of 1915, by M. DE PEYERIMHOFF, Inspector of Forests and Director of the Forestry Station of Algiers. In this latter case, it appeared on the trunks of olive trees attacked by the larvae of *Cossus* which had bored out a number of galleries in the wood. The manna was particularly abundant and huge stalactites hung from the whole length of the trunk.

M. DE PEYERIMHOFF thinks the rarity of the occurrence is due to the fact that *Cossus* only very seldom attacks olives.

Experiments have been begun in order to attempt to induce this phenomenon at will, which, if successful will be of considerable practical importance.

406 – **On the Coagulation of *Hevea* Latex and a New Method of Coagulation.** — EATON B. J. and GRANTHAM J., in *The Agricultural Bulletin of the Federated Malay States*, Vol. IV, No. 2, pp. 26-30. Kuala Lumpur, November 1915.

RUBBER, GUM AND RESIN PLANTS

When latex is allowed to coagulate spontaneously in open vessels, a peculiar slime or yellow scum forms on the surface. This surface scum is alkaline in action while the serum below is acid, thus showing two distinct processes of decomposition *viz* : an alkaline aerobic process and an acid anaerobic process. This latter is the basis of a patent anaerobic process of coagulation in which the latex is allowed to coagulate in tall cylinders so as to reduce the amount of aerobic decomposition.

Latex sterilised in an autoclave at 140°-150° C. remained uncoagulated after several days under sterile conditions, but on exposure to air or after inoculation with a little fresh latex, coagulation set in after 24 hours, showing that coagulation is dependent upon bacterial decomposition.

Latex heated to 90°-100°C. and kept under sterile conditions coagulates spontaneously without putrefactive change, the serum becoming slightly acid. Putrefaction, however, sets in later.

The writers conclude from these results that coagulation is not due to an enzyme but to bacterial action of a non-putrefactive nature.

There are therefore two kinds of bacteria capable of developing in latex according to the conditions, the putrefactive organisms being inhibited at a lower temperature than the non-putrefactive organisms.

Experiments were then made to increase the activity of the non-putrefactive organisms by the addition of sugars and it was found that the addition of 0.2 per cent of dextrose brought about coagulation in 18 hours, the whole of the dextrose being completely decomposed. The addition of dextrose to sterile latex did not bring about coagulation.

Coagulation under anaerobic conditions is not uniform, since it depends on the constituents of the latex. This method, therefore, does not give a rubber of uniform quality.

SUGAR CROPS

407 – **Experiments on Sugar-Beet Growing in the South-West of France.** — POUYGUES H., in *Comptes-Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 162, No. 3, pp. 136-138. Paris, January 17, 1916.

In France, the cultivation of sugar-beet has been restricted hitherto entirely to the northern provinces. As this state of affairs is not without drawbacks and even danger, the writer has attempted the growing of this crop in other regions, particularly the South West. In 1914, experiments were carried out in the following departments: Lot-et-Garonne, Gironde, Dordogne, where tobacco is grown. Comparing the nature of the soils suited to the two crops, it was considered that where tobacco was cultivated the beet should also succeed: both require deep, moist, but not wet, soils and both are suited by clayey loams or by clayey chalk soils with a good supply of humus.

Owing to the scarcity of labour, the only experimental fields to receive sufficient preparation were those situated in one of the fertile regions of the Causses du Quercy, in 1914, and those on the alluvial lands of the Lot valley, in 1915. The results in these two cases are given in the appended table and show that at any rate the sugar varieties of beet root are capable of being grown with profit in South West France.

1) The average yield per acre in the Lot valley is slightly higher than that for the north of France (according to MALPEAUX, 13.98 tons per acre).

2) The average yield of sugar is at least equal to that obtained in the North of France.

3) The lands of the fertile regions of the Causse (a calcareous plateau between the Lot, the Tarn and its tributaries) are equal in fertility to the alluvial lands of the Lot valley, as far as the sugar varieties are concerned.

On the other hand, distillery beets did less well in the Causse than in the alluvial soils where they showed a sugar content equal to that produced in the North.

4) Climatic conditions being the same for the 4 departments men-

| Varieties tested | Results in 1914 | | Results in 1915 | |
|---|---|---|---|---|
| | Cwt. per acre | Sugar content | Cwt. per acre | Sugar content |
| *Sugar* | | | | |
| Vilmorin . . . . . | 298.8 | 15.6 | 318.6 | 17.6 |
| Klein-Wanzleben . . . . . | 278.8 | 17,1 | 320.2 | 17.4 |
| *Distillery* | | | | |
| White with green neck . . . | 286.8 | 7.5 | 312.9 | 14.2 |
| » » pink . . . . . | 293.9 | 6.8 | 306.7 | 12.8 |
| » » grey . . . . . | 286.8 | 9.5 | 312.9 | 11.5 |

tioned above, it may be assumed without further trial that the lands similar to those of the Lot valley are well suited to this crop. Such are: those extending, in Dordogne, from Eyzies to Sarlat and from Sarlat to St. Foy-la-Grande ; those of Lot and Garonne which lie between Fumel and Tonneins passing by way of Villeneuve-sur-Lot and St. Livrade.

408 – **Varieties of Strawberry Tested at the New York Experiment Station.** — TAYLOR O. M., in *New York Agricultural Experiment Station, Geneva, Bulletin* No. 401, pp. 165-192 Geneva N. Y. March 1915. HORTICULTURE

A description of 105 varieties of strawberry tested and examined during the last 3 years at the New York Agricultural Experiment Station. The kinds grown include newer varieties, with standard commercial kinds for purposes of comparison. As climatic and soil conditions have a great effect upon the crop, those obtaining at the Station are given, in order that a better opinion can be formed of the results of the tests of the different varieties.

Attention is drawn to the importance of the various properties of the strawberry plant, such as the seasons of blooming and ripening, the sex of the flowers, stolon production, productiveness, vigour of plant, resistance to disease and the size and quality of the fruit. The varieties are classified as follows : early or late bloomers ; varieties maturing early or late ; those that are prolific or scanty plant producers ; very unproductive or very productive varieties ; those growing rapidly or slowly ; varieties susceptible to leaf spot (*Sphaerella fragariae*) ; kinds producing very large or very small fruit ; varieties rating high in quality.

A list is then given of the 30 varieties that gave the best results in the cultivation tests at the Station, and finally a detailed description of the 105 kinds studied, with an account of their behaviour under the soil and climatic conditions obtaining at the Station.

The place of origin of the variety is given in each case.

409 - **The Cultivation and Manuring of *Oxycoccus* (*Vaccinium*) *macrocarpus*.** — FRANKLIN H. J. in *Massachusetts Agricultural Experiment Station, Bulletin* No. 160, Report of Cranberry Substation for 1914, pp. 91-117. Amherst, March 1915.

*Frost Protection.* In order to see whether cloth could be used satisfactorily to protect bogs from frost, a strip of new cloth was supported by wires held 3 ft. above the ground by stakes, about 9 square rods of rather dry grassy low land being covered in this way, the cloth being brought down to the ground to shut in the covered area on all sides. It was found that the cloth greatly retarded the loss of heat from the ground. A thermometer placed in the centre of the covered area, with its bulb 5 in. above the ground was more than 4 ½° F. higher (2.2° C.) than a similar thermometer at the same elevation placed about 20 ft. outside the cloth. No frost formed on the covered ground, even when the surrounding ground was white with frost.

The writer estimates that the first cost of this means of protection fully installed would be less than £ 200 per acre, but the cloth ought to give good service for many years. He is of opinion that the use of cloth protection is to be recommended for bogs that are winter flowed, but for strictly dry bogs (without winter flowage) the expense is prohibitive, because the returns from such bogs are comparatively small.

*Fertilising experiments.* These were carried out with either one compound, or a mixture of 2 or 3 compounds ; to one plot which was treated with a nitrogen-phosphatic-potassic fertiliser, lime was also applied. The amount of fruit picked was taken into account, as well as the losses in the stored fruit. The yield varied from 6 ⅓ bushels to 10 ⁴/₅ bushels per acre ; both these amounts being obtained from a control (unfertilised) plot. The fertilisers consisting of 3 compounds increased the yield more than those consisting of 2 ; sulphate of potash was more efficacious than chloride of potash ; liming had not much effect. Of the different compounds used, nitrogen increased the yield to the largest extent.

During storage, the losses varied from 22.22 per cent (check) and 37.25 per cent (complete fertiliser and liming). The nitrogenous fertiliser decreased the keeping property of the berries somewhat, as it made them more juicy. The fertiliser had no appreciable effect upon the size of the berries. The application of nitrogenous fertilisers during the beginning of the bloom seemed to stimulate and increase the setting of the blossoms and the fruit formation.

*Maximum temperature at which flooding water can oe used without damage to buds.* — Some cranberry growers were afraid that if the temperature of the water of the June reflowage were too high, serious damage might be done to the buds of *Vaccinium* ; the writer, however, found that an exceptionally high temperature : 86° F. (30° C.) did practically no harm to the buds.

410 – **Experiments in Italy on the Best Time for Pruning the Vine.** — DALMASSO G., in *La Rivista*, Year XXII, No. 3, pp. 44-47. Conegliano, February 1, 1915.

The question as to whether it is best to prune the vine early or late cannot yet be said to have received a satisfactory answer and it seems increasingly necessary to extend the observations made under different climatic, soil and cultural conditions.

| Date of Pruning | No. of vines per row | No. of the row | Average yield per vine | Composition of must | | Index of ripening |
|---|---|---|---|---|---|---|
| | | | | Sugar | Acidity | |
| | | | lb. | % | ‰ | |
| November 15 | 106 | IV | 2.51 | 21.00 | 6.65 | 3.15 |
| | 105 | XI | 2.58 | 20.30 | 6.18 | 3.28 |
| | Average of 2 rows | | 2.54 | 20.65 | 6.41 | 3.22 |
| December 15 | 105 | V | 2.82 | 18.80 | 6.84 | 2.74 |
| | 107 | XII | 2.03 | 22.00 | 6.00 | 3.66 |
| | Average of 2 rows | | 2.43 | 20.40 | 6.42 | 3.17 |
| January 15 | 106 | VI | 2.89 | 21.15 | 6.93 | 3.05 |
| | 107 | XIII | 2.31 | 22.30 | 6.18 | 3.60 |
| | Average of 2 rows | | 2.60 | 21.72 | 6.55 | 3.34 |
| February 15 | 106 | VII | 2.14 | 20.90 | 6.75 | 3.11 |
| | 106 | XIV | 1.21 | 20.70 | 6.56 | 3.44 |
| | Average of 2 rows | | 1.68 | 21.80 | 6.65 | 3.27 |
| March 15 | 101 | VIII | 2.38 | 21.35 | 6.18 | 3.45 |
| | 107 | XV | 1.50 | 21.45 | 6.37 | 3.36 |
| | Average of 2 rows | | 1.94 | 21.40 | 6.27 | 3.41 |
| April 15 | 102 | IX | 2.61 | 21.15 | 6.18 | 3.42 |
| | 104 | XVI | 1.17 | 21.70 | 6.75 | 3.21 |
| | Average of 2 rows | | 1.59 | 21.42 | 6.46 | 3.31 |
| May 15 | 62 | X | 1.19 | 20.75 | 6.00 | 3.46 |

New investigations have been begun in the vineyards of the " R Scuola Enologica " at Conegliano, on the 2 following varieties: a vine of the Italian Riesling variety growing on level ground and pruned according to the Guyot method, and a vine of the Rhenish Riesling variety planted on a slope. Although the data of a single year are only of a very relative value, still the results observed in the two cases were so markedly paralle that they deserve immediate notice. They are given in the appended Table.

As regards *quantity*, late prunings (in spring) do not seem to have yielded such satisfactory results as autumn and winter pruning. The effect upon the *quality* of the product is less obvious. The continuation of the experiments will prove whether or not the observations of the first year represent a normal occurrence.

411 – **Observations on the Cultivation of Direct Bearers in Savoy (France) in 1915.** – CARTIER F., in *Le Progrès agricole et viticole*, Year 36, No. 46, pp. 473-476., Villefranch (Rhône), November 14, 1915.

Observations made by the writer on 2 vineyards situated near Aix-les-Bains, on slopes of fairly calcareous nature but with clayey spots. One with due southern aspect was very warm, dry and early, there being in some places only from 20 to 30 cm. of soil above the rock. These vineyards have never been fertilised. The year 1915 being a very bad one for vines, many growers in this district only obtained grapes from direct bearers, but others also got fairly good crops from certain *vinifera*. Of these, the most attacked were the " douce-noire ", or " corbeau ", and the " crépy ", or " fendant roux ". The writer obtained, in 1915, from his direct bearers, a better crop than in 1914 with a slight treatment towards July 10 (some spots of mildew) the first applied for 8 years.

The following numbers are considered the best for 1915.

*Old Hybrid Direct Bearers.* — 580 Jurie does very well in the plain, while on hot and dry slopes it sometimes loses its leaves (1911 and 1915). It is the only direct bearer that has a high degree of acidity, even when perfectly ripe, which corrects the insipidity of the must of the greater number of the other hybrid direct bearers.

Of the *Seibel Old Hybrids*, 2044 has always proved very productive; 405 is very resistant to drought in the worst soils, even those that are calcareous ; its fine bunches escaped the attacks of Cochylis ; 2007 remained quite healthy without treatment ; being exceedingly productive, it is necessary to prune it rather close ; 1007 is very productive and very healthy ; 209 bears largely with 1 or 2 treatments. Of the *Old Couderc Hybrids*, 3304 has proved very productive, vigorous and healthy, its bunches and grapes are better that thse borne by 4401 ; 122-20, 106-51 and 7103 are also distinguished for their good grapes.

*White Gaillard* 157 has always proved a good producer; it is not too vigorous and consequently needs grafting on poor soils ; after 3 years it becomes chlorotic in the spring on calcareous soil.

*New Hybrid Direct Bearers.* — *Seibel Hybrids*: 2779, first and second period of ripening ; very productive, vigorous, juice white ; 2582, very pro-

ductive, less vigorous, bunches very long ; juice coloured ; 4591, extremely vigorous, habit of 405 but more productive ; 4499, large producer, vigorous. These 4 kinds require 1 or 2 treatments. — 4669 very vigorous, large fine fruit, very productive ; 4643, 4683, 4629, 4636, varieties with very fine bunches, and grapes above the average ; 4433 and 4438, large bunches ; 4109 very vigorous, one of the hardiest varieties, very long bunches ; 2734 very vigorous, habit and foliage same as Othello, excellent grapes with raspberry flavour. These 9 kinds are very resistant to mildew and can dispense with treatment in ordinary years. — The following numbers require at least 2 sprayings and are only of average vigour ; they are very productive and have very fine compact bunches with lage grapes : 4207, 4217, 4111, 3011, 3013 and 4065 (very early) ; the 2 last produce table grapes. On poor soils, these numbers require grafting, especially 4111 and 4217.

Among the *Seibels with white grapes*, the following are recommended : 880, very resistant to mildew and very productive, sweet grape, requires a good soil ; 2709 and 4132 have fine bunches with large grapes ; 4744 and 4947 require two sprayings with copper sulphate. The following numbers are more vigorous : 4955 very productive ; 4595, 4747, 4707, 4773, 4768, and especially 4076 and 4762, all very productive, belonging to the first and second period of ripening, 2859 (rose) ; 4999 ; 4964 all these numbers only require one application of copper sulphate ; 2655, with very fine bunches, late setting, 4151 and 3013, all very productive of grapes for the vat and for table, but less vigorous than the preceding. They require, at least, 2 sprayings and on poor soils need grafting.

Amongst the *Seibels with black grapes*, Nos. 2858, 5059, 4199, 4739 and 4646 have proved vigorous and very resistant. *Malègue rouge* 869-2 and 459-3 proved very vigorous, they require one spraying.

*Chenivesse*, or *Chazalon*, is delicate and susceptible to mildew, and needs 2 treatments.

*Bertille Seyve Hybrids.* — 313, a very good grape, first period, a little susceptible to Oidium ; 822 vigorous, very good crop ; 453, fine bunches with close fruit ; 893, first period, excellent grape, very productive ; 450 white, a Noah without foxy flavour but much more productive, with large fine bunches. All these Bertille-Seyve numbers of the first and second period are very resistant to mildew and can possibly do without spraying.

*Couderc Hybrids.* — 272-60 is very vigorous and very productive in good, fresh soils, unsatisfactory on the dry soils of the slopes, susceptible to Oidium. 239-35 or Muscat du Moulin is vigorous and very resistant ; it produces an excellent table grape.

*Baco Hybrids.* — Vines 1, 22A, Capéran, Petit Boué and Chasselas are all very resistant to mildew ; the first is extremely vigorous.

In general, all the hybrids here mentioned grow best and are most vigorous in the plain, especially on damp soil ; many are susceptible to scorching and the heat of the sun during drought ; some ripen better in damp than in dry years ; such as for example 126-25 Couderc, which ripens better in the shade than in the sun ; 2044, 580 etc.

The grapes of direct bearers are generally fermented in the country, mixed with *vinifera* grapes, as they decrease the acidity and improve the colour of these latter; the wines obtained sell well for immediate consumption. On the other hand, even the original direct European-American bearers (Othello, Noah), are acclimatised in Savoy, and have now lost to a great extent their former foxy taste.

412 – **Vine-Growing in California.** — SWETT, F. T., in *The Monthly Bulletin of State Commission of Horticulture*, Vol. IV, No. 11, pp. 491-493. Sacramento, Cal., November 1915.

At the present time, in California, the future of the grape industry, like that of the apple and peach industries, is decidedly unsettled. It will need the wisdom of legislators, the skill of technicians, and the ability of business men to carry it through the coming decade without incurring severe losses, the effects of which would fall heavily on growers of grapes, on banks, on business men and on wage earners.

The growth of the grape and wine industry in California has been steady, continuous and rapid, as is shown by the increase in the average quinquennial returns of wine production from 1869 to 1914. The total amount of wine produced in each five-year period, in round number of gallons, is 16 million, 21 million, 42 million, 71 million, 89 million, 96 million, 142 million, 187 million, 225 million.

There are now 170 000 acres of wine grapes. In addition, a large part of the product of table grape vineyards and of raisin grape vineyards goes to the wineries. This steady growth, which is due to high prices obtained by the growers, is in contrast to the violent fluctuations of the orchard business. The latter, with few exceptions, fell off greatly between 1900 and 1910, as is shown by the following statistics taken from the report of the State Board of Agriculture.

*Comparative Table of Fruit Trees in California in* 1900 *and* 1910.

| | 1900 | 1910 | Decrease |
|---|---|---|---|
| Apples | 2 878 169 | 2 482 762 | 395 407 |
| Apricots | 4 244 384 | 2 992 453 | 1 251 931 |
| Pears | 2 512 890 | 1 410 905 | 1 101 985 |
| Cherries | 686 891 | 522 304 | 164 587 |
| Olives | 1 530 164 | 836 347 | 693 817 |
| Lemons | 1 493 113 | 941 293 | 551 820 |
| Pomelos | 80 918 | 43 427 | 37 491 |
| Almonds | 1 601 947 | 1 166 130 | 435 217 |
| Plums and prunes | 9 832 713 | 7 168 705 | 2 655 088 |
| Totals | 24 852 189 | 17 564 326 | 7 277 343 |

During the ten-year period, 1900-1910, the acreage of the above 9 varieties of fruits dropped from 248 000 to 175 000, a shrinkage of nearly 73 000 acres.

In the meantime, the vineyard acreage during the same time has grown to a total of about 330 000, composed of about 170 000 of wine grapes, 110 000 raisin grapes and 50 000 acres table grapes. Nevertheless, owing to the heavy internal revenue tax levied recently by Congress on wines and on the brandies used in the fortifying of sweet wines, the wineries of the interior valleys have already cancelled contracts for at least 40 000 tons of grapes. The tonnage of table grapes that can be used this season by the wineries is, however, doubtful.

With a full crop of table-grapes, about 20 000 carloads are shipped, but during the last 3 years, an average of only about 6 500 a year were exported, with perhaps 1000 cars a year used in local markets. The rest were sold at a loss to the wineries. It is beyond dispute that table grapes have been over planted, an excessive and ruinous oversupply of mid-season grapes having been grown; there is, however, room for more early grapes of good quality and for more late grapes of good keeping quality.

The State Board of Viticultural Commissioners made an exhaustive study of the financial losses incurred by shipping unripe grapes and proposed a law which came into force in 1915, the "Ashley Standardization Law" which provides that grapes must contain a minimum of 17 per cent of sugar for all grapes except the "Emperor".

The Commission is also devoting its attention to the questions of replacing mid-season grapes by early and late kinds, and of grafting the "Zante", "Almeria" and "Emperor" varieties.

The writer states that there is a tendency among such owners of vineyards as have sufficient capital or credit, to replace every third vine with a prune, pear, almond, or some other fruit tree. He is of opinion that, in view of the great importance of the agricultural undertakings in California, it is increasingly necessary to study the economic problems, which at present seem to overshadow the technical ones, and in conclusion, agriculturists are reminded that agriculture, the one large industry that from present appearances can never be overdone in California is to be based largely upon general farming and animal industry.

## LIVE STOCK AND BREEDING.

413 – **Studies on the Heredity of Rabies.** — KONRADI DANIEL in *Annales de l'Institut Pasteur*, Vol. XXX, No. 1, pp. 33-48. Paris, January 1916. HYGIENE

Work carried out at the Institute of Pathology and General Therapeutics at Kologsvár, Hungary. The writer had previously shown that the infectious matter of rabies is transmitted from the mother to the embryo. Subsequently to the publication of these articles, other experiments were made on the same subject with contradictory results. The writer crit-

icises these experiments and gives an account of his later researches, from which he draws the following conclusions :

1) The infectious matter of rabies is transmitted from mother to fœtus, but is attenuated in the process. This explains why rabies manifests itself by degrees, following, as it does, the gradual removal of virus from its source.

2) As regards this transmission, there seems to be no difference between different species of animals; it occurs equally in dogs, rabbits, guinea-pigs, and probably in the case of the other animals also.

3) In order to obtain good results from inoculation, guinea-pigs, and not rabbits, must be used, and the injection should be made beneath the meninges. Guinea-pigs being more susceptible to rabies, give more rapid and certain reactions. As rabbits only contract rabies very late, and are sometimes immune, their use may lead to erroneous conclusions being drawn.

4) In the case of guinea-pigs it is also very important to prolong the time of observation, since these animals also contract the disease much later than those that are inoculated with virus from the mother.

5) The virus is already circulating in the blood of the animal infected when fever, the first sympton of induced rabies, makes it appearance. By means of the blood it is transmitted from the mother to the fœtus, some weeks and even months before death.

6) The bite of a dog is already dangerous 14 days before the appearance of the characteristic clinical symptoms.

414. – **Treatment of Foot-and-Mouth Disease by means of Hellebore.** — SANFELICE LUIGI, in *Il Moderno Zooiatro*, Series V, Year V, No. 1, pp. 17-20, Bologna, January 31, 1916.

The root of hellebore is an old empirical remedy which has been completely abandoned by ordinary medical and veterinary practice. The writer, on the other hand, in the course of a long career, has never completely abandoned its use and has lately obtained excellent results in the treatment of the malignant form of foot-and-mouth disease.

Whereas the symptoms of the benign form of this disease are the appearance of large vesicles on the mouth and feet accompanied by a varying amount of fever which ceases directly suppuration sets in, those of the malignant form are minute vesicles on the gums and insignificant lesions on the feet accompanied by very high fever. The cause of the second form is apparently some infective agent still unknown which, gaining access to the organism, acts directly on the blood by attacking the plasma, thus influencing the most important nerve centres.

For the benign form, any treatment based on antiseptic dressing is effective.

In the treatment of the malignant form, the writer has made use of fixation abscesses, that is to say of revulsives provoking the formation of foci of induced inflammation in parts of the body removed from the infected centres ; these foci attract the germs and toxins infecting the blood and thus cause the resumption of phagocytosis by the leucocytes. Injections were begun with turpentine, but this treatment is impracticable for

cattle as the strong dose required would be sufficient to impart an odour to the flesh and render it useless should it be necessary to slaughter these animal suddenly. Recourse was then had to the root of hellebore, the following method being adopted :

Some 10 to 15 roots of hellebore are taken, according to the age and size of the animal, and allowed to macerate in vinegar for 15 minutes. After preliminary disinfection, a longitudinal incision is made in the fetlock, the scalpel penetrating the cellular tissue ; the root is then fixed firmly in the wound and allowed to remain for 48 hours. At the end of that time it is withdrawn, the flesh slightly scarified, and the wound is cauterized, disinfected and bandaged. The resultof the treatment is to cause a swelling of an inflammatory nature extending as far as the neighbourhood of the sternum, with secretion of purulent serum.

Should no swelling of the fetlock be observed at the end of 24 to 36 hours, the case will have a fatal termination : if the reverse be the case, a cure is certain.

In the course of an outbreak there occurred among 4000 head of cattle, 900 cases of epizootic foot-and-mouth disease, of which 81 were of the malignant type. Of this latter number, 17 succumbed to the apoplectic form, 13 were treated with the usual antiseptics and 51 with roots of hellebore. Except in 2 cases where the disease was too far advanced to give the local reaction, all the remaining 49 animals were cured.

415 - **Single Food Diet and Nutritional Deficiency.** — WEIL E. and MOURIQUAND G., in *Comptes-Rendus des Séances de la Société de Biologie*, Vol. LXXIX, No. 1, pp. 37-39. Paris, January 22, 1916. FEEDS AND FEEDING

It is generally admitted that a diet consisting exclusively of one food or of a limited number of foods is the cause of nutritional troubles which may culminate in a very serious organic breakdown and even in death. The occurrence of scurvy, beri-beri and certain infantile diseases are explained in this manner.

On the other hand, milk and potatoes (the latter sometimes the sole food of certain portions of the population in Ireland) are two examples of exclusive diets which do not necessarily occasion nutritional troubles.

A series of experiments has shown that :

1) Pigeons fed exclusively on whole cereal grains (rice, barley, wheat, maize) follow their normal development.

2) Feeding with the same grains completely devoid of husk causes " deficiency " troubles (polyneuritic and cerebellar type) followed by death.

3) An exclusive diet of barley only partially husked ($^1/_4$ or $^1/_5$ of husk still remaining) is sufficient to maintain the birds in health.

4) Complete sterilisation of barley grains causes " deficiency " troubles absolutely identical with those occasioned by their decortication.

5) Feeding of cats on an exclusive diet of fresh raw or frozen meat sustains life for a long period, whereas the same meat sterilised (at 120° C.) causes (in 25-35 days) nervous derangement followed by death.

The above facts show that a single food diet becomes harmful only after sterilisation or, in the case of cereal grains, decortication.

A varied diet is undoubtedly more suitable to the organism than one consisting of a single food. Feeding pigeons with a mixture of unthreshed grains has also been shown by experiment to be more favourable to growth than feeding with a single species of decorticated grain. But if the pigeons be given a mixed ration (wheat, barley, rice) of decorticated cereal grains, there occur, after 14-24 days, symptoms of paralysis followed by death, just as in the case of the ration consiting of decorticated grains of a single species of cereal. So that not only has the variety in the diet been unable to effect normal nutrition but it even seems (judging from the rapidity with which troubles appear) to have hastened " deficiency " troubles.

In conclusion, the writers have compared the influence on the nutrition of the rabbit, of a given vegetable ration in the raw and cooked or sterilised states. In the case of the raw ration the health of the animals was not impaired after 100 days of experiment. In the case of a varied sterilised ration (1 ½ hours at 120° C.) troubles of a scorbutic type appeared towards the 35th day and resulted in death. Again the varied nature of the diet was incapable of protecting the animals from " deficiency " troubles.

The decortication and sterilisation of cereals and the sterilisation of meat and vegetable removes from these foods " vital " substances or " ferments " (vitamines of FUNK) the presence of which in infinitesimal quantities assures the assimilation and utilisation of the ordinary nutritive substances (proteids, carbohydrates, fats).

It is the suppression of these substances by sterilisation or decortication and not the exclusive nature of the diet which, in the preceding experiments, seems to be the primary factor in inducing deficiency troubles and death.

416 – **Formation of Albumen in the Animal Body at the Expense of Nitrogenous Non-Albuminoid Substances.** — STUTZER, in *Fühlings Landwirtschaftliche Zeitung*, 64th Year, No. 11-12, pp. 281-295. Stuttgart, 1915.

The syntheses of albumen only occurs in a small degree in the body of domestic animals, as with normal feeding they draw chiefly upon the albumen of the forage.

However, ABDERHALDEN'S experiments have shown that the formation of albumen by synthesis may occur in animals when the necessary constituents are present. The components of albumen may be divided into 2 groups: amino acids of the fat series and amino compounds of the aromatic series. The chief members of the second group are trytophane and tyrosine.

The formation of amino-acids sometimes takes place in the liver of animals at the expense of carbohydrates (glycogen) and ammonia. The substance intermediate between the carbohydrate and ammonia on the one hand and the amino-acid on the other is a cetonic acid. Consequently, there is only formation of amino-acids belonging to the fat series and the synthesis of albumen is impossible if there are not present in the liver amino compounds of the aromatic series.

The writer makes the following statements based on his own and on previous experiments :

1) Carnivora and omnivora are capable of forming albumen synthetically when, in addition to amino-acids of the fat series, there are also present in the body tryptophane and tyrosine.

2) Carnivorous animals are capable of drawing upon a certain quantity of amino compounds and of urea for certain physiological needs. If the food is poor in albumen there is at most a state of nitrogen equilibrium in the body as these nitrogenous compounds protect the albumen of the fodder against decomposition.

3) Herbivorous non-ruminant animals behave similarly to carnivores and omnivores.

4) Ruminants behave differently on account of the large number of bacteria living in their stomachs and intestines, except in the case of young animals in which the paunch is not yet sufficiently developed.

5) Ruminants which yield no milk may make use not only of certain amino compounds (asparagin), but also of ammoniacal salts (ammonium acetate) by transforming them by the aid of bacteria into a species of albumen known as "bacterial" albumen (Bakterieneiweiss) which is partly utilised by the animals. However, this process takes place only when the forrage is rich in carbohydrates and contains a certain quantity of albumen (not too small). The productive value of this albumen is also much smaller than that of the albumen of the fodder. The asparagin or ammonium acetate which is added to fodder increases the digestibility of the crude cellulose and the nitrogen free extract — Experiments of a similar kind with urea have not yet been made in the case of the above class of animals.

6) On administering fodder sufficiently rich in albumen to ruminants yielding milk, and on adding asparagin to the fodder, effects of two different kinds may be observed :

*a*) the asparagin does not react ;

*b*) the asparagin stimulates the udder in such a way that the milk yield is greatly increased at the expense of the meat. When a portion of the albumen of the fodder is replaced by amides or by ammonium acetate, the milk yield is always decreased, because the quantity of albumen formed by the bacteria at the expense of these substances is not sufficient to make up for the deficit in the albumen of the fodder. From the scientific point of view, it is interesting to note that ruminants may, in certain cases, make use of the albumen formed by the bacteria for milk production and body maintenance, but from the practical point of view the interest is limited owing to the fact that the economic value is *nil*.

Similar experiments with urea have not yet been made in the case of ruminants giving milk but it may be assumed that this substance behaves in similar manner to ammoniacal salts.

417 – **Experiments with Ammoniacal Salts in the Feeding of Ruminants.** — MORGAN A., in *Deutsche Landwirtschaftliche Presse*, Year 43, No. 16, p. 129. Berlin, February 23, 1916.

An account of feeding experiments with ammonia salts (especially the acetate) on ewes and goats extending over a period of four years. The animals were first fed a ration containing, on an average, 2.3 to 2.5 kg. of digestible albumen per 1000 kg. of live weight. In 24 cases, part of the albumen was afterwards replaced by acetate of ammonia, and in 14 by carbohydrates in the following proportions : 36 per cent of albumen the first year ; 44 per cent the second year ; 62 per cent the third and 56 per cent the fourth.

The results of these experiments expressed as percentages of those obtained with the ration containing the full proportion of albumen are given in the table bellow.

The results of the experiments may be summarised as follows :

1) Substitution of acetate of ammonia for part of the albumen caused a decrease in the quantity and richness of the milk. The smaller the albumen content of the fodder, the poorer the milk.

2) The substitution by carbohydrates of the same amount of albumen still further reduced the quantity and richness of the milk.

3) Acetate of ammonia had less effect upon the milk yield, the lower the albumen content of the forage.

Acetate of ammonia can thus only partially replace albumen. In the digestive tract (especially the paunch) it is transformed by bacteria into albumen which is utilised by the animals. It is considered that acetate of ammonia is capable of replacing part of the albumen, not only in a maintenance ration, but also for production. It must, however, not be used in too large quantities, for fear of ruining the health of the animals. It is better only to use acetate of ammonia in cases where albumen is entirely absent.

*Results of Experiments* (*Values stated as percentages*).

| | Acetate of ammonia | | | | Carbohydrates | | | |
|---|---|---|---|---|---|---|---|---|
| | No of animals | Milk produced | Dry Matter of Milk | Fat | No of animals | Milk Produced | Dry Matter of Milk | Fat |
| 1st year . . . | 1 | 93.7 | 98.9 | — | 7 | 78.0 | 75.4 | 76.2 |
| 2nd » . . . | 9 | 92.7 | 91.1 | 02.5 | 6 | 94.1 | 88.8 | 85.9 |
| 3rd » . . . | 9 | 69.6 | 67.8 | 67.2 | — | — | — | — |
| 4th » . . . | 5 | 75.1 | 72.6 | 72.0 | 2 | 63.7 | 62.4 | 63.4 |

BREEDING

418 – **The Heredity of Sex** (1). — *The Journal of Heredity*, Vol. VII, No. 1, pp. 9-11. Washington, D. C. January 1916.

Under ordinary conditions, for every 100 female calves born in a herd of cattle there will be 107 male calves. Many cases have, however, been noticed in which the proportion was very different.

(1) See also *B.* March 1916, No. 320. (*Ed.*)

Thus, in a herd of registered dairy cattle, about 75 per cent of all the calves born in recent years have been males, while in another case a cow (which has beaten the world's record for milk production) and its two sisters dropped 12 male calves and only 1 female. The study of the ancestry of these animals revealed, both in the first and second case, an hereditary tendency to produce more offspring of one sex than of the other. The possibility of obtaining by selection a breed of fowls that has a tendency to produce disproportionate numbers of one sex has also been proved. Mr. H. E. SHARP, a breeder of the State of Washington, has developed a strain of Langshan fowls that are producing over 90 per cent females, and this trait is being transmitted from generation to generation ; he has also found that amongst the chickens hatched from the eggs of a single fowl, the proportion between the males and females varies very little with the change of the cock with which the hen is mated, or from one year to another, whereas it varies enormously in the case of different fowls of the same lot.

The inbreeding experiment of Dr. HELEN DEAN KING at the Wistar Institute, Philadelphia, has given results which lend some colour to the belief that a strain of animals may be produced having a tendency to produce disproportionate numbers of one sex. The experiment has been carried out for 6 years, and during this time more than 22 000 albino rats have been bred and studied. From the same litter 2 males and 2 females were taken ; inbreeding was practised to the 6th generation without any special selection ; 2 pairs were taken from this generation, the one (brother and sister) from a litter containing an excess of males, the other from a litter containing an excess of females. There has been steady selection in the opposite direction through 21 generations with strict inbreeding of the animals selected. The result is that, instead of a normal ratio of 107 males to 100 females (which was established at the beginning of the experiment) Dr. King now gets in the one line 150 males to 100 females, and in the other, 65 males to 100 females.

419 - **A New Type of Cattle for Alaska.** — *The Journal of Heredity*, Vol. VII, N. 1, p. 48, 1 fig. Washington, January 1916. CATTLE

No breeds of dairy or beef cattle have as yet been found hardy enough to stand the winters in the interior of Alaska without excessive expense for food and protection against cold. As a result, milk sells for 50 cents a quart and the beef that is consumed in the country consists almost wholly of cold-storage meat brought from the outside. To remedy this situation as far as possible, the Alaska Experiment Station have undertaken to cross Galloway cattle with the Yak, an Asiatic ox much used by Mongolians, Tibetans etc., for milk and meat as well as work. It is used for a beast of burden at altitudes of 12 000 ft. and more. It is extremely hardy, pastures through the winter under the open sky in Siberia and obtains feed from last year's dead grass dug from under the snow. Crosses of the Yak and ordinary domestic cattle are common in parts of Asia (for example in Turkestan) and have been found of much value.

GOATS

420 – **Experiments in Germany on the Causes of Sterility in Male Goats.** — WESTER J., in *Deutsche Tierärztliche Wochenschrift* Year 23, No. 52, pp. 451-457, with figures. Hanover, December 25, 1915.

A detailed study of sterility in male goats. According to the writer, sterility in goats is chiefly due to the male, whereas with cattle the contrary is the case. Sterility in the male goat may be either *partial* and *temporary* or *total* and *permanent*.

I. Partial and temporary sterility is found in the following cases :

1) When the male goat is weakened by disease.

2) When it is badly fed.

3) When a male goat serves too large a number of females it has generally not sufficient spermatozoa to fertilise them all. This, however, in the writer's opinion, is quite an individual character, since there are examples of quite exceptional sexual potency; thus a good Flemish goat has served 17 females in a single day and 350 in one season, most of which did not need to be put to the male a second time.

4) Onanism is also a cause of sterility.

All the foregoing cases of sterility are curable.

II. — Total and permanent sterility can be induced by various causes, of which the following are the principal.

1) *Cryptorchism and hermaphroditism.* — These defects are more observed in the male goat than in the stallion or bull, but the consequences are less serious in the first-named animal. These cases of sterility are transmissible by the parents.

2) *Sterility due to closure of the seminiferous ducts.* — This is the most common form of sterility and causes enormous losses in goat-breeding. Among 25 male goats examined by the writer, 22 had this defect.

The closing of the seminiferous ducts is caused by the induration of the cells of the testicle, epididymis or hilum, generally of all three at once. The induration process usually commences in the testicle, where the spermatozoa, owing to the closing of the seminiferous ducts, form calcified nuclei.

Where a portion of the ducts is closed, the fertility of the goat is not affected, but if the whole of the ducts gradually becomes closed, the animal becomes completely sterile.

When the duct of the epididymis is entirely closed, the goat is completely sterile, even when large quantities of spermatozoa still remain in the testicle.

Goats with these defects generally retain the desire to cover, but the seminal fluid containing no spermatozoa the female remain sterile. The disease is easily recognisable in its advanced stages, the testicles being too small and soft. The hilum is thickened, as is also the epididymis.

In the early stages, on the contrary, this disease is difficult to recognise without examining the seminal fluid.

Attempts to discover the fundamental cause of this defect have led to the conclusion that it is probaly hereditary. The sterility of male goats is a trouble met with everywhere but it is less common in some countries. In Germany, most sterile male goats are to be found in Hesse. Of the 25

animals examined by the writer, 24 came directly from Hesse, or were the offspring of parents born in that province.

When purchasing male goats for breeding purposes it is first necessary to ascertain that the genital organs are well formed ; animals should not be bought till they are old enough to permit of conclusive examination. If sterility is difficult to diagnose, recourse must be had to microscopic examination of the seminal fluid.

The article contains numerous illustrations of transverse sections of diseased testicles.

121 – **Experiments in Swine Feeding at the Oregon Agricultural College Experiment Station.** — WILTYCOMBE JAMES, POTTER ERMINE L. and SAMSON GEORGE R., in *Oregon Agricultural College Experiment Station, Bulletin* No. 127, 30 pp. Corvallis, Oregon, March 1915. PIGS

The results of 24 experiments in pig-feeding made at the Agricultural Station of the State of Oregon during the last 10 years ; the common feeds used in Oregon for the fattening of pigs were given to the animals. The following is a summary of the results of some of the most interesting of the experiments.

In one of the experiments, 16 high class pigs, 4 1/2 months old, from pure-bred Yorkshire sows and sired by a pure-bred Berkshire boar were divided into 2 lots which were as equal as possible. Both lots were fed ground wheat, while one received skim milk and the other shorts, as a supplement. The total rations fed the 2 lots had the same nutritive ratio and were measured so as also to contain the same amount of nutritive substances. The experiment lasted 62 days. The results are given in the table below. Taking into account the expense of rearing and fattening and of the maintenance of the sow during gestation and the keep of the young pigs till the beginning of the experiment, the feed cost for the first 100 pounds of live weight was $ 4.94. The cost of each further 100 lb. gain was $ 6.09 for the lot fed on shorts and $ 4.45 for the lot given skim milk, so that the total feed cost of each 200 pound pig was $ 11.03 in the case of lot I and $ 9.84 in that of lot II.

In another experiment, there were 3 lots of 10 pigs, each of which received the same ration consisting of ground barley 90 per cent and tankage (slaughter house refuse) 10 per cent. Lot 1, hand fed twice daily, ration dry ; lot 2, fed with self feeder, ration dry ; lot 3, hand fed, twice daily, ration soaked twelve hours before being fed. Throughout the experiment the animals of lot 2 made the most progress and gave the best final result after the 61 days of the experiment, as is seen in the table. This lot also consumed more food per head, while the amount of food necessary to produce 100 pounds of live weight was less in this lot than in the 2 others. The largest increase in live weight per head daily was 2.44 pounds and the smallest 1 pound ; in both cases the pigs were barrows. The 10 best pigs were 7 barrows and 3 gilts (daily increase per head 2.44 pounds — 1.75 pound). Of the 10 pigs showing the smallest gains in live weight (1.56 pounds — 1 pound) 5 were barrows and 5 gilts. The 10 pigs that were intermediate between these 2 lots (1.73 — 1.56 pounds) consisted of 8 gilts and only 2 barrows. The

writers conclude from this that male pigs show a greater variability in live weight than female pigs.

In the last experiment, 2 lots, each of 10 pigs, received a dry ration of 92 per cent of ground barley and 8 per cent tankage and were fed by self-feeders. The first lot were kept in a covered pen, while the second lot were allowed to feed in a clover field at will. The two lots were uniform as to the size, sex, breeding and quality of the animals. The experiment lasted 44 days and the results obtained are given in the following table.

| Experiment | Lot of pigs | Live weight per head | | Consumption of food per head daily | | | Increase in live weight per head daily | To produce 100 lbs. of live weight | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Initial. lbs. | Final. lbs. | | | | | Consumption of food | | | Feeding Cost |
| | | | | lbs. | | | lbs. | | | | $ |
| | | | | Shorts | Ground wheat | Milk | | Shorts | Ground wheat | Milk | |
| I. | 1 | 106 | 101 | 1.76 | 3.5 | — | 1.21 | 145 | 290 | — | 11.03 |
| | 2 | 103 | 205 | — | 4.1 | 7.2 | 1.64 | — | 246 | 440 | 9.48 |
| II. | 1 | 101.0 | 191.7 | 6.88 | | | 1.48 | 462.73 | | | 6.82 |
| | 2 | 101.4 | 213.0 | 7.71 | | | 1.82 | 421.07 | | | 6.31 |
| | 3 | 98.9 | 193.0 | 6.93 | | | 1.54 | 449.84 | | | 6.65 |
| | | | | Barley | Tankage | Clover. | | Barley | Tankage | Total. | |
| III. | 1 | 89 | 157 | 5.530 | .480 | — | 1.545 | 357.524 | 31.117 | 388.97 | — |
| | 2 | 89 | 173 | 6.429 | .559 | *ad lib.* | 1.909 | 336.784 | 29.285 | 366.07 | — |

422 – **"Clover Flour" as a Feed for Pigs.** — Zur Herst V. A., in *Illustrierte Landwirtschaftliche Zeitung*, Year 36, No. 3, pp. 13-14. Berlin January 8, 1916.

The "clover flour" sold in Germany for feeding pigs is made by grinding young clover which has been thoroughly dried previously. It is fed with potatoes, beans etc.

In order to determine the food value of this new fodder, a feeding experiment was carried out with 10 sows, upwards of one year old, which had farrowed in the spring of 1915. During the summer and autumn of the same year, the animals were turned out to pasture, where they only received a small additional ration of young green clover and afterwards beetroots. On October 28, the sows were put in the sty for fattening. Until the 25th. of the following November, their ration consisted of crushed beans, potatoes, fish meal, acorns and beetroots.

Its feeding value corresponded to that established by Kellner. The increase in live weight during this period was 0.44 kg. per head daily.

Calculating the value of the kilo at one shilling, the experiment resulted in a loss of £ 4.7.6 for the lot of 10 animals.

From November 25, the sows were given, instead of the beans, a ration of clover flour (starting with 2 litres, or .44 of a gallon per head at each meal) which was fed mixed with fishmeal and boiled potatoes, with the addition of cold water. This ration was given with some small modifications until December 19, on which day the experiment finished. During the experiment, the animals were always in good health.

During this second period, the live weight of the sows increased considerably, namely 1.38 kg. per head daily. The lot of 10 animals gave a profit of just over £14.

Although this estimate does not allow for all possible expenses, it can be said that the productive value of the clover flour had proved excellent.

It is therefore considered that this new food, if fed with fish meal and boiled potatoes, is an excellent feed for fattening purposes.

423 – **On the Effects of Feeding Pituitary and Corpus Luteum Substance to Growing Chicks** (1). — PEARL, RAYMOND (Biological Laboratory, Maine Agricultural Station) in *Proceedings of the National Academy of Sciences*, Vol. 2, No. 1, pp. 50-53. Washington, D. C., January 1916. FORESTRY

These experiments were carried out to determine the effect of pituitary substance on the function of egg production in the domestic fowl. Forty-five pure-bred Barred Plymouth Rock pullets all hatched the same day were divided into three lots of 15 each. They were chosen so that the total weights of the three lots were equal. Pituitary substance (anterior lobe) contained in gelatine capsules with lactose was given to one lot at the rate of 0.082 gr., per bird per day. A second lot of pullets received the same amount of dessicated corpus luteum substance from pregnant cows and a third lot was kept as a control.

Though all the birds remained in a perfect state of health throughout the experiment, both the corpus luteum and the pituitary substance retarded the growth, the effect being greater in the case of the lot receiving corpus luteum.

There was no evidence that the pituitary substance hastened in any way the initial activity of the ovaries of the pullets.

Thus it appears that both glandular substances retard growth in the chick without affecting the date of sexual maturity or interfering with normal physiological development.

424 – **Two Pheasant Crosses.** — PHILLIPS JOHN C. in *The Journal of Heredity*. Vol. VII, N. 1, pp. 12-16, 3 figs. Washington, January, 1916.

In a preceeding paper (2) the writer described a reciprocal first cross between Reeves' pheasant and the common ring-neck pheasant (*Phasianus torquatus*). It was shown that the males differed very perceptibly in the two crosses, but of the females nothing could be learned because only one female was reared from the cross of male ring-neck female Reves', and none at all in the other cross.

(1) See also *B.* January 1915, No. 76; *B.* August 1915, N. 838. (*Ed.*).
(2) See *B.* February 1914, N. 155. (*Ed.*).

In order to find out whether these sterile reciprocal hybrids *always* differed in the male sex, and also whether the females would show any differences, another cross was carried out as a check upon the first experiment. But in the second experiment, the Prince of Wales pheasant (*P. principalis*) was used instead of the *P. torquatus*.

The *P. principalis* belongs to the dark-necked, red-rumped group. The striking features of the male are briefly as follows : neck-ring absent, lesser and median wing coverts white, with white shaft stripes on greater coverts ; rump and upper tail coverts orange red, with a few fine black dots ; tail barring reduced to faint lines.

The Reeves' pheasant, *Syrmaticus reevesii*, belongs to a monotypic genus. The male is entirely unlike any of the true pheasants (*Phasianus*) in coloring, and has a tail 3 or 4 feet long. The upper surface of the body is bright golden-colour, with black edgings to the feathers of the mantle, back and rump, while the breast and flanks are barred with white, black and chestnut. The head is strikingly marked with black and white. The female Reeves' pheasant shows some of the male characters in her lace pattern and the colors of her mantle, breast, and flanks.

The two species crossed are therefore wholly unlike in both sexes and in all plumages, and always produce absolutely sterile hybrids. In 1914, a Reeves' cock was mated with two Prince of Wales females (Pen *J* 1914) and a Prince of Wales cock was placed with a couple of Reeves' females (Pen *K* 1914). Both these parent stocks were inbred and came from the same grandparents.

From Pen *J* nine birds were reared to maturity, four males and five females, and from Pen *K* one male and three females. Comparing the two pens of males and the two pens of females we get the following result :

In the 1914 cross, Reeves' male × Prince of Wales female (cross *J*) and in the reciprocal cross (*K*) the sterile male hybrids are similar and closely approximate to the slightly different reciprocal hybrids of the Reeves × ring-neck experiment of 1912. With the females, however, of the two first mentioned crosses, there are almost no points in common. In cross *J* they are small, female-like, and very close to the Reeves female in their colouring. In cross *K* they are large and male-like, with pattern and coloring of both the male parents. No trace of a sex gland was found in any of these females, but a small and thin-walled oviduct was always present.

It is possible that these facts may be explained on the basis of sex linkage, with the assumption that the eggs are dimorphic, and the sperms monomorphic for sex and sex linked characters, but no proof is available on account of the impossibility of testing the sterile hybrids.

Rough measurements of the spleen cells failed to reveal any difference of their size betwen *K* and *J* females.

425 - **Laying Competition at Burnley.** — Brown Edward, in *The Journal of the Board of Agriculture*, Vol. XXII, No. 7, pp. 658-662. London, October 1915.

For nine years, the Northern Utility Poultry Society, which is largely composed of artisans in a great manufacturing centre, has conducted lay-

ing competitions. The competition described in this article extended from October 15, 1913, to October 4, 1914.

In no part of the United Kingdom has the keeping of poultry for egg production, as a supplementary pursuit, been developed during recent years to a greater extent than around Burnley. The development has been more or less intensive in its nature owing to local conditions (high cost of land, the fact that all food must be provided, large local demand and high prices paid for eggs), and the average productiveness of the hens is of supreme importance, since without increase of fecundity, the margin of profit would be insufficient.

In view of the desirability of encouraging egg production in industrial areas, the Burnley example is of considerable value, and these laying competitions have exerted a wide influence.

For the purpose of the competition of 1913-14 a small holding of three acres was rented. The competition was arranged in 4 sections :

1) *Small House Section.* — The ordinary small house was used in this section : 12 ft. by 8 ft. and 5 ft. 6 in. high at the eaves, rising to 8 ft. at the centre, with a run allowing 30 sq. yds. for each bird.

2) *Semi-Intensive Section.* — A large flock was located in a house measuring 36 ft. by 15 ft. high at the eaves, rising to 11 ft. in the centre and allowing 3 ½ sq. ft. of floor space for each bird. Outside was a run divided into four sections for alternate use.

3) *Local Section*: restricted to competitors within a radius of eight miles of Burnley, the houses used being similar to those in No. 1.

4) *Dry Feeding Test*: in which were birds representing 4 noted laying strains.

Each of the small houses used accommodated 234 birds ; in Section 2, 156 birds were placed in the large house, grouped into two lots, heavy and light breeds respectively. Each competitor in the open sections was required to enter 8 birds, 4 in the Small House Section and 4 in the Semi-Intensive Section. Comparisons between the two can be made, as the feeding and other conditions were the same, the only differences to be noted being as regards the size of house and the number of inmates.

The following table shows the differences as to average number of eggs laid per hen.

It is evident that the smaller flocks (small houses) yielded a larger number of eggs in winter, though the differences are small in the aggregate. Except in one case, this difference is more apparent with heavy than with light breeds. How far the better results obtained with the small houses make up for the greater cost of equipment and of labour, requires further proof.

The Dry Feeding Test did not prove successful ; the 16 birds never presented the same bloom and vigour as the others, especially during the winter. The dry feeding consisted of equal parts of bran, biscuit meal, scraps, ground oats and biscuit dust with 10 per cent of fish meal as a dry mash, and of equal parts of wheat, oats, cockle and kibbled maize, or broken barley mixed and given in an automatic feeder.

*Average Number of Eggs Laid per Bird Annually in the Small and the Large Houses.*

| Breed | Number of Pullets | Number of Eggs in Large House | Number of Eggs in Small House |
|---|---|---|---|
| White Wyandottes | 48 | 174.62 | 192.35 |
| Buff Orpingtons | 16 | 136.75 | 142.31 |
| Buff Rocks | 4 | 140.25 | 163.25 |
| Rhode Island Reds | 4 | 181.00 | 167.75 |
| White Leghorns | 68 | 166.30 | 166.94 |
| Anconas | 16 | 181.81 | 173.06 |
| All Breeds | 156 | 167.13 | 172.98 |
| Heavy Breeds | 72 | 164.65 | 178.25 |
| Light Breeds | 84 | 169.23 | 168.10 |

During the competition, which lasted 1 year, 71 709 eggs were produced ; of these 13 526 (or 18.86 per cent) were laid in the winter cycle (October to January inclusive), this percentage being distinctly above the average. The cost of food under such conditions must always be heavy. In this competition it worked out at 7*s.* 4*d.* per bird, per annum. The value of eggs sold per bird was 19*s.* 3*d.*, and the average price was 1*s.* 4 $^1/_2$ *d.* per dozen.

426 – **The Ancestry of the Goose.** — *The Journal of Heredity*, Vol. VII, No. 1. pp. 39-45, 4 figs. Washington, January 1916.

The ordinary breeds of domesticated geese are the slightly modified descendants of the grey lag goose (*Anser anser* L.) which is still found wild throughout northern Asia, although nearly extinct in Europe. It had already been domesticated at the most remote period of civilisation. There appears to be in *Anser anser* and its tame descendants, as well as in the Chinese species (*Cygnopsis cygnoides*), a strong tendency to the production of white mutants and from these the white variety of both species has been created. As a rule, the changes due to domestication (waddling walk, lessened ability to fly and deeper rump) are those that would naturally be produced by selection of specimens possessing the best marketable form.

The American Standard of Perfection recognises the following breeds of geese : Toulouse (gray) Embden (white), African (gray), Chinese (both brown and white varieties), Wild or Canadian (gray) and Egyptian (coloured). Of these, the " Toulouse " seems to have been produced in France ; its plumage much resembles that of *A. anser* but the colour pattern is simpler. The Embden " has been obtained by North German breeders in and around Westphalia by selecting white " sports " and breeding from

them. The history of the " African " breed is somewhat uncertain. It is said to be a cross between the Chinese goose, the Toulouse breed and sometimes the Embden. The fleshy protuberance on the beak is characteristic of domesticated forms of the Chinese species, also the black stripe down the back of the neck, while the plumage resembles to some extent that of the Toulouse goose. The 3 above-mentioned breeds are heavy weight or market varieties, weighing from 17 to 25 lb. when properly fattened.

The Egyptian breed comes from an entirely different species (*Chenalopex aegyptiacus*) which has been of much importance to the domestic economy of Egypt ever since the beginning of history.

The Canadian goose is the domesticated wild goose of North America (*Branta Canadensis*). It is easily tamed, but has little commercial importance as a domesticated breed. The Chinese goose (*Cygnopis cygnoides*) lays well and furnished a good quality of meat; it is the largest of all wild geese and weighs from 10 to 14 lb. It is yearly becoming more popular in the United States and deserves to be widely kept. All these species can be interbred freely in captivity.

427 – **Parthenogenesis in the Silkworm.** — LÉCAILLON A. in *Comptes-Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 162, No. 6., pp. 234-236. Paris, February 16, 1916. SILKWORMS

Observations made in June 1914 and June 1915 (with moths of the univoltine breed) with a view to solving the vexed question of the parthenogenesis of *Bombyx mori*. The following conclusions were drawn:

1) Oviposition in the case of females that cannot mate becomes very irregular.

2) A certain number of unfertilised eggs can undergo changes in colour similar to those shown by fertilised eggs which develop normally. This is in agreement with previous observations.

3) Shaking unfertilised eggs is incapable of increasing the number that change their colour. In this experiment the eggs were placed in cardboard boxes immediately after they were laid and shaken vigorously for 5 minutes and again several times during the next 3 days.

4) The action of sulphuric acid (diluted in an equal volume of water and allowed to act for 5 minutes on unfertilised eggs) is also negative.

5) It seems logical to conclude, as all previous workers have done, that the changes of colour undergone by certain eggs are a proof that parthenogenesis occurs in the case of the silkworm; only a cytological study, however, is capable of deciding the question definitely.

428 – **Food of the Rainbow Trout (*Salmo irideus* Gibb.) in Alpine Lakes.** — KAISER, VETCH L. and FEHLMANN J. W., in *Schweizerische Fischerei-Zeitung*, Year 23, No 12 pp. 320-325. Pfäffikon (Zürich), December 1915. FISH.

A preliminary account of observations made early in October 1915 at the Hydrobiological Station at Davos (Switzerland). (1).

(1) See *B.* March 1916, No. 329. (*Ed.*)

The fish under observation were 5 months old and were derived from the hatchery at Heuweise, near Buchs. The plankton of Lake Davos which forms the food of the larvae is chiefly composed of species of *Daphnia, Cyclops* and a Centropogid *Diaptomus denticornis* Wierz. This latter, which is red in colour owing to its carotin content, forms practically the entire food of the rainbow trout. Not only are the stomachs of the fish completely crammed with specimens of this crustacean but their excreta are coloured a vivid red by the carotin.

This is all the more curious in view of the fact that *Daphnia* forms a much greater proportion of the plankton of the lake than *Diaptomus* and, being sluggish in its movements, is much more easily caught than *Diaptomus* which is a good swimmer and very active. Parallel experiments with the fry of the common trout (*Trutta fario*) have shown that this latter fish is more catholic in its tastes.

This observation is regarded as being of considerable importance and throws light upon some common, but hitherto obscure, phenomena. It also confirms the results of several other authors. Dr. G. Surbeck in an article on the stocking of alpine lakes with rainbow trout has already suggested that the red colour of the trout in lake Sul is due to the presence of large numbers of *Diaptomus*. Unfortunately, he omits to give the exact name of the species, which might possibly be *D. bacillifer* Koelbel as this latter also shows the characteristic red colour. At the same time it may be assumed that *D. denticornis* was the species concerned, as *D. bacillifer* lives chiefly at altitudes ranging from 7900 to 8900 feet and, according to Zschokke, has only been found three times at a lower altitude than 5940 feet whereas lake Sul is only 6320 feet above sea level. Further the two species never occur together. More recently, Leger has concluded, from his experiments on the stocking of alpine lakes that, contrary to the prevailing opinion, the rainbow trout is the best species for this purpose.

In view of the fact that the rainbow trout of Lake Davos possesses the same red flesh as those of Lake Sul and that *Diaptomus denticornis* forms practically the entire food, not only of the fry, but probably of the adult fish also, it may be concluded that the red coloration of the flesh of the rainbow trout in the alpine lakes is derived from *Diaptomus denticornis*.

We thus have the reason why the rainbow trout, contrary to expectation, does not leave Lake Davos, notwithstanding the fact that this latter has an outlet and the flow of the water is favourable. It is because the fish find food to their taste such as does not occur, for instance, in the lakes of the plain, in spite of their richness in insects, larvae, small fish etc. This theory is confirmed by the fact that the rainbow trout does not usually leave the lakes of the plain as a one or two year old fish, but only at maturity or thereabouts, as if it were then anxious to find a spot which would ensure a suitable food supply for the larvae.

The point of practical value in connection with these observations is that henceforward it will be possible to determine immediately whether or not an alpine lake is suitable for stocking with the larvae of *Salmo iri-*

*deus*. Where the plankton is shown to contain *Diaptomus denticornis* this species will succeed well.

The red colour of *Diaptomus* cannot be the reason for the larvae preferring this species to the exclusion of all others but less obvious factors must be concerned, either of a purely mechanical or possibly of a biochemical nature. Undoubtedly, *Diaptomus* should be the cause of much more rapid growth on the part of the fish as, owing to their preference for this species, they eat considerably more than they would otherwise do.

*Cyclops* and *Daphnia* are thus only eaten by young rainbow trout when there is nothing better to be had. If, however, the fish make such strict selection from among the living plankton, it is obvious how little appeal must be made by such substitutes as pieces of spleen, brain, liver, fish meal etc. The degeneration observed in the fish of the waters of the plain is possibly due to the unsuitable diet in their early stages. In Lake Davos this degeneration has not been observed. It follows from this that the hatcheries which can feed their larvae with *Diaptomus denticornis* furnish the healthiest and quickest growing fish. Breeding of *Salmo iridens* should therefore only be carried out in the alpine lakes and not in the plain. This method should enable breeding trout from alpine lakes to be substituted for those imported from their native waters, often at considerable expense, in order to reinvigorate the population of the waters of the plain.

## FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

429 – **Chaff-cutter with Curved Blade and Plate for Packing the Straw**. — *Illustrierte Landwirtschaftliche Zeitung*, 3rd. Year, N° 10, pp. 61-61 + 4 figs. Berlin, Feb. 2, 1916.

The chaff-cutter patented by the firm of Heinrich Schrameyer of Halsbergen, near Osnabrück, Germany, (German patent N° 289 461) differs from others already in use, through the fact that the plate for compressing or packing the straw forms part of the feeding tube, being joined to the lower portion of this latter and pressing the straw against the side opposite, nearest to the blade. By means of this arrangement, the sheaves are well chaffed without having been previously opened out, *i. e.* just as they come in from the field.

The chaff-cutters employed hitherto have the following drawback: when cutting is begun, the sheaves being tied round the middle their ends only partially fill the orifice of the feeding tube, and they are consequently pressed unevenly in the plane of the blade. This latter does not meet with the resistance necessary for clean cutting and as a result a portion of the straw is crushed and torn instead of being properly cut.

To overcome this difficulty, in the new chaff-cutter the packing plate is arranged in such a way that directly the blade begins to act the plate presses the straw against the opposite side of the feeding tube and ensures a clean cut.

Fig. 1 shows the machine in side view and fig. 2 in front view. Figs. 3 and 4 show the method of working of the packing plate and of the blade :

*Chaff-cutter with Curved Blade and Plate for Packing the Straw.*

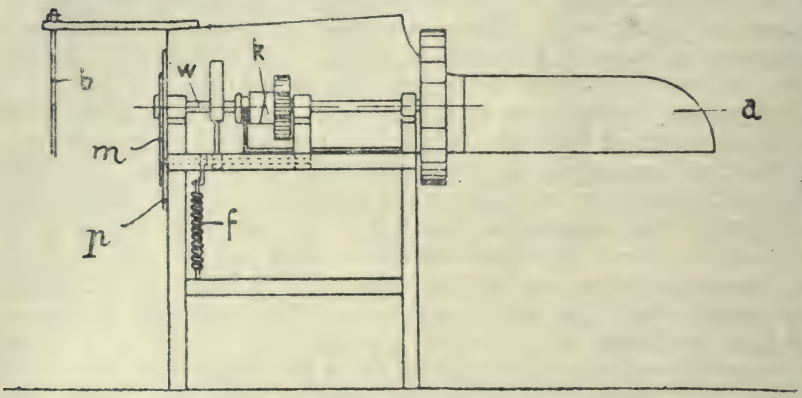



Fig. 1

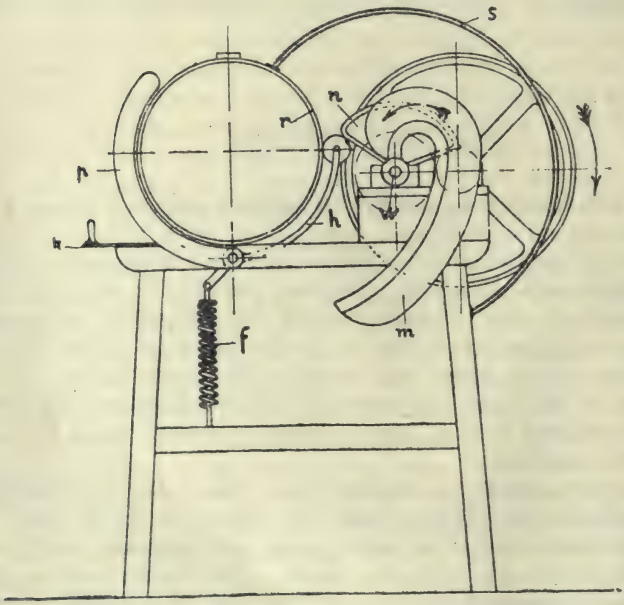



Fig. 2

Fig. 1. — Machine in side view.
Fig. 2. — Machine in front view.

in fig. 3 the straw, still in its loose condition, does not completely fill the interior of the feeding tube and neither plate nor blade have yet begun to

act ; in fig. 4 the packing plate has pressed the end of the sheaf against the opposite wall and the blade has begun to act.

Examination of the figures shows that (fig. 1) the curved plate *a* on which the sheaf is placed is followed by a cylindrical tube *r*, into which the straw is fed until stopped by a plate *b* adjustable according to the length of cut required. A curved plate *p* (figs. 2-3-4) is hinged to the lower part

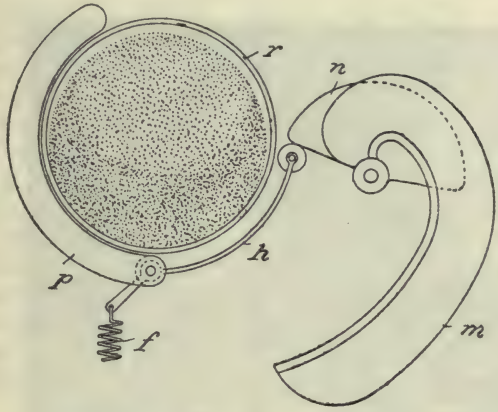



Fig. 3

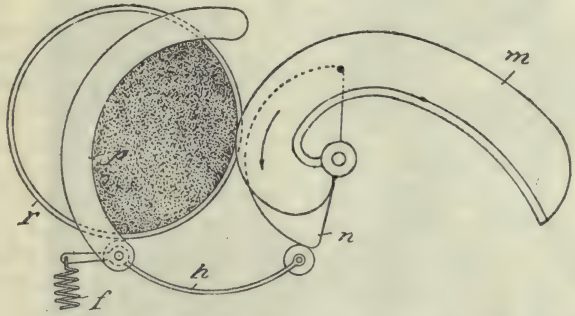



Fig. 4

Fig. 3 and 4. — Mode of action of blade and packer.

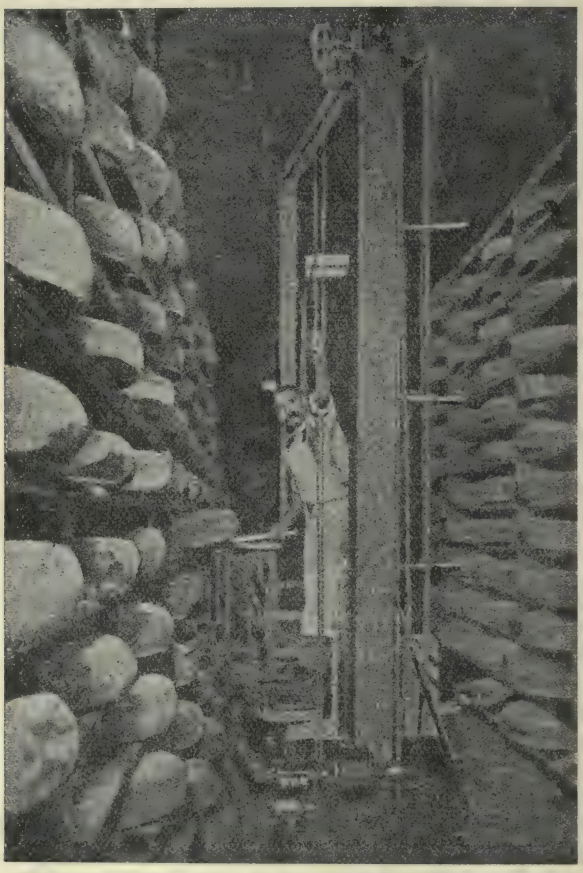
of the feeding tube and is maintained in the open position by means of a long spring *f*. A curved arm *h* is connected with the plate *p* and through the agency of a roller presses against the cam *n* mounted on the shaft *w* of the blade *m*. This latter, revolving in the direction of the arrow, grazes the plate *p* in scissor fashion ; the knife is worked by a gear driven off a pulley. The bush *k* (fig. 1) enables it to be thrown in and out of gear at will. The blade is protected by a guard *s*.

430 – **Apparatus for the Cheese Curing Room.** — *Schweizerische Milchzeitung*. Year 42, No. 14, p. 3. Schaffhausen, February 18, 1916.

Hitherto all the work of salting and cleaning cheeses in curing or store rooms required a good deal of labour, as every cheese had to be removed

from the shelves, carried to a table to be treated and then put back into its place, all by hand. When large and heavy cheeses have to be salted two or three times a week the work becomes especially fatiguing, since the cheeses on the upper shelves are often 10 or 12 feet from the ground

M. DAVID LÖRTSCHER of St Gallen, the inventor of the cheese moving apparatus "Merkur" at present in general use, has devoted some years



Apparatus "Mars" for the manipulation of heavy cheeses.

to the study of the problem and has now invented the portable cheese salting table "Mars" worked by hand or power, which effectively saves a vast amount of labour in the curing or store room.

The apparatus, shown in the accompanying figure, consists of a kind of lift mounted in a frame on rollers, so as to be easily moved in the passages

between the rows of shelves. The lift platform is suspended by two strong wire ropes between two uprights.

Part of the platform is occupied by a cleverly constructed salting table fitted with a device for turning the cheese over, leaving sufficient space for the workman. A 1 ½ HP. electric motor is sufficient to propel the whole apparatus forwards and backwards, or to raise close up to the top shelves and lower to the ground the platform and salting table together with the man and three heavy cheeses. The lift is fitted with automatic stops. The salting table and the platform are provided with rollers covered with rubber and worked by electricity.

When the table has been lifted to the proper height the rubber roller on the table is placed under the part of the cheese projecting beyond the shelf. The roller is set in motion and draws the cheese into the table where it is treated. By a simple device the heaviest cheeses are turned over without any exertion on the part of the operator, and by reversing the motion of the roller the cheese is returned to its place on the shelf. For the lower shelves the table is removed, the platform itself acting as table, being provided with the necessry rollers and turning device.

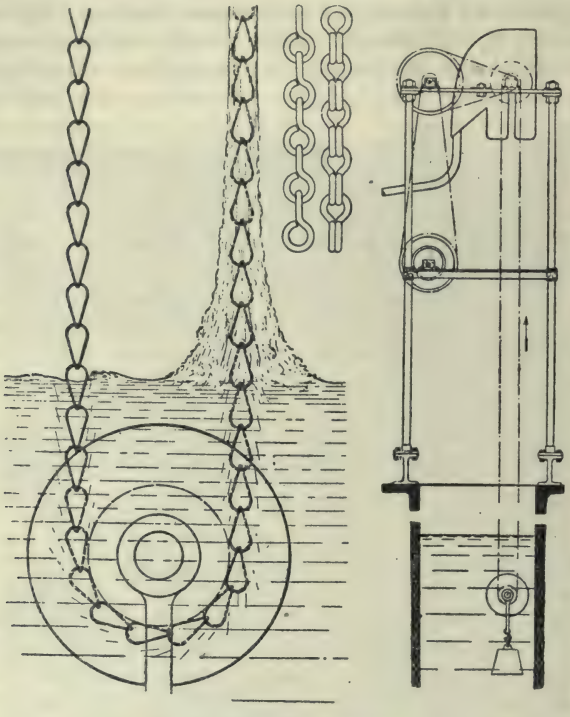
As electric power is not everywhere available this apparatus is also constructed for hand power. It is built in different sizes to suit any height and width of passage.

431 – **Chain Pump or Conveyor.** — *The Practical Engineer.* Vol. 53, No. 1507, p. 20. London, January 13, 1916.

A number of chain pumps have already been devised, some consisting essentially of tubing fitted with piston disks, the chain merely connecting the disks, others of series of little buckets, and others again of a compound endless chain — carrying the liquid by capillarity and adhesion — which is formed by a central chain surrounded by two metal wire helical springs. Messrs J. C. GRANT and A. JARVIS have now found by experiment that water either alone or carrying solids in solution or suspension can be very efficiently lifted by a simple bare chain, though the quantity varies considerably with the pattern and size of the chain. The form of chain found most suitable is the double jack chain, of which a few links are shown in the accompanying illustration, each link having a single and a double loop in planes at right angles to each other.

The example illustrated is for raising water from a well. A small pulley having a V groove is mounted on a shaft supported on a framework above the well and driven by a hand wheel. Over the pulley passes an endless chain long enough to descend beneath the level of the water in the well and passing round a submerged weighted pulley, also V grooved. The upper pulley is mounted in a casing with a chute into which the water is discharged. On rotating the chain rapidly, the rising run lifts the water which forms a cone shaped mass at the surface and gradually assumes a cylindrical form round the chain. The upper pulley must be of small diameter to give a sudden change and direction to the chain and throw off the water. The submerged pulley may be of ample diameter. Sand and water even

in the proportion of 6 lbs. to a gallon can be readily lifted by the above system, which has been patented.



Chain for conveying water.

## 432 – Review of Patents.

*Tilling machines and implements*

| | |
|---|---|
| Denmark | 20 842. Device for motor ploughs. |
| Italy | 150 283. Motor plough. |
| | 150 689. Improvements in the winding drums [used for mechanical ploughing. |
| | 150 851. Harrow. |
| Spain | 60 943. Plough beam. |
| | 61 155. Plough with twin bodies and only one mouldboard. |
| | 61 185. Improvements in disk harrows. |
| Sweden | 39 624. Device for cultivators. |
| Switzerland | 71 775. Garden implement. |
| United States | 1 164 774. Stalk cutter. |
| | 1 164 792 — 1 166 144. Cultivator attachment. |
| | 1 165 097 — 1 168 135. Motor plough. |
| | 1 165 213 — 1 165 857. Harrows. |
| | 1 165 267. Reversible disk plough and cultivator. |

1 165 297. Ditching plough.
1 165 527. Harrow attachment for gang ploughs.
1 165 808 — 1 166 169 — 1 166 207 — 1 167 683. Ploughs.
1 166 135 — 1 166 446 — 1 167 122. Cultivators.
1 166 195. Cotton chopper and cultivator.
1 167 429. Motor plough and cultivator.
1 167 645. Weed cutter and pulverizing machine.
1 167 969. Combined drag and harrow.
1 168 158. Combined lister and fertilizer distributor.
1 168 201 — 1 168 202. Wheel cultivators.
1 168 208. Wheeled plough.

*Manure distributors.*

Italy 150 630. Rake fertilizer distributor.
United States 1 165 490. Fertilizer distributor.
1 166 632. Straw spreading attachment for manure spreader.
1 165 642. Manure loader.

*Drills and sowing machines.*

Denmark 20 869. Drill.
Sweden 39 563. Share for drills.
United Kingdom 19 756. Potato planting and manure distributing machine.
United States 1 166 477 — 1 167 814. Seed and fertilizer distributor.
1 166 502 — 1 166 962. Planters.
1 167 438. Check-row corn planter.
1 167 545. Drill attachment.
1 167 551. Disk grain drill.
1 167 662. Seed feeding apparatus for cultivators with disks and elastic teeth.
1 167 907. Potato planting attachment.

*Reapers, mowers, and other harvesting machines.*

Denmark 20 793. Canvas conveyor for binders.
20 821. Horse rake and stacker.
20 848. Reaper.
20 877. Sheaf carrier for reapers.
Switzerland 71 666. Device for lifting the cutter-bar of mowers and throwing them into and out of gear.
71 776. Apparatus for sharpening scythes.
United Kingdom 19 767. Sheaf binding harvesters.
United States 1 164 691. Cutter bar for harvesting machines.
1 164 713. Mowing machines.
1 165 169. Guard means for the cutting mechanism of binders, mowers etc.
1 165 319 — 1 165 650 — 1 166 329. Grain shocking machine.
1 165 758. Corn harvester.
1 166 136. Side-delivery rake.
1 166 594. Hay unloader.
1 166 963. Attachment for hay rakes.
1 167 213. Seed harvesting attachment for mowing machines.
1 167 651. Hay loader.
1 167 739. Grain loading machine.
1 167 911. Grain carrier for harvesters.

*Machines for lifting root crops.*

| | |
|---|---|
| United States | 1 166 083. Machine for topping beets. |
| | 1 166 762. Beet harvesting machine. |

*Threshing and winnowing machines.*

| | |
|---|---|
| Spain | 60 887. New threshing machine. |
| | 61 014. Machine for winnowing and grading all kinds of grain and pulse. |
| | 61 269. Elevator riddle adaptable to any system of threshing machine. |
| | 61 270. Improvements in threshing machines. |
| United States | 1 165 241. Threshing machine, maize sheller or like machine. |
| | 1 165 786. Threshing machine. |
| | 1 166 647. Corn husking machine. |
| | 1 166 730. Pea and bean thresher. |

*Machines and implements for the preparation and storage of grain, fodder etc.*

| | |
|---|---|
| Spain | 69 877. Frames for baling hay, straw cotton, cork etc. |
| Switzerland | 71 913. Electrostatic groats cleaning machine. |
| United States | 1 164 922. Baling press. |
| | 1 167 858. Alfalfa meal grinder. |
| | 1 167 871. Ensilage protector. |

*Dairying machines and implements.*

| | |
|---|---|
| Denmark | 20 813. Pulsator for milking machines. |
| | 20 849. Milking machine. |
| | 20 855. Drum for separators. |
| Netherlands | 1 053. Implement for treating milk for the preparation of cheese. |
| United Kingdom | 20 417. Cow milkers. |

*Other agricultural machines and implements.*

| | |
|---|---|
| Denmark | 20 829. Peat kneading machine. |
| British India | 2 186. Improved methods of separating fibres from seeds and apparatus thereto. |
| Italy | 150 211. Pincers for marking live stock. |
| | 150 819. New sprayer for insecticides and anti-mildew liquids. |
| Spain | 60 945. Filtering plates for beetroot filtering presses. |
| | 60 975. Machine for cutting cork slabs into sheets. |
| | 61 010. Boring machine for discovering water at small and considerable depth. |
| | 61 084. Improvement in machines for sharpening the knives of machines for cutting cork disks. |
| | 61 267. Apparatus for the carriage of bananas. |
| Sweden | 39 438. Overhead carrier for stables. |
| Switzerland | 71 877. Device for tying up vine canes. |
| | 71 878. Device for untying live stock in stables. |
| United States | 1 165 481. Steering device for tractors. |
| | 1 165 708 — 1 166 246. Tractors. |
| | 1 165 930. Motor driven tractor. |
| | 1 167 302. Traction engine. |

433 - **Small Circular Reservoirs in Reinforced Cement.** — PARIS, RAFFAELE, in *Giornale di Agricoltura della Domenica*, XVXIth Year, No 9, p. 68, 3 figs. Piacenza, Feb. 27, 1917. BUILDING CONSTRUCTION

The system proposed by the writer consists essentially in the construction of 2 walls of reinforced cement which form the sides of the embankment. These latter are connected transversely and thus ensure stability

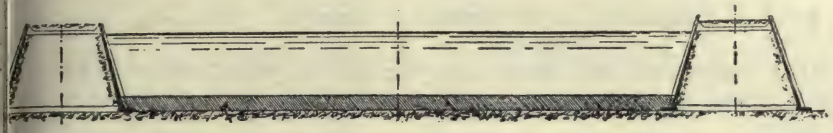



Fig. 1. — Vertical section through reservoir.

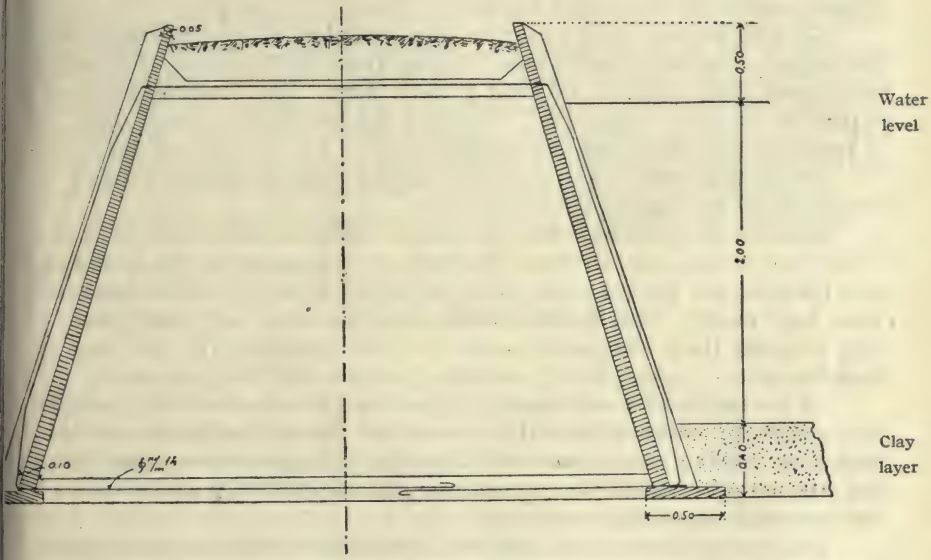



Fig. 2a. — Vertical section of earth-filled embankment.

without the necessity for constructing the ordinary embankments which are so much more costly.

By means of this system, the weight of earth necessary to oppose a unit volume of water may be reduced to a minimum; the walls of reinforced cement render the sides impermeable. By covering the bottom with a layer of clay this latter is also rendered waterproof and the heavy expenses in connection with foundations are divided. As shown in Fig. 2, the walls are formed of cement tiles which may be reinforced with a network of metal. The tiles are strengthened at the cross joints by means of ribs; their length is thus limited to the distance between the said joints.

The expenses necessary for a plant sufficiently large to irrigate 61.8

acres supplying 5716 cubic feet of water per acre every 10 days are estimated at a little less than £400. Of this sum nearly £80 is required for a motor pump, estimating a difference in level of 82 feet and a flow of 2.64 gallons per second, and £278 for the construction of a reservoir of 17 658.5 cubic feet capacity (1).

434 – **Effect of Temperature on the Strength of Concrete.** — *Engineering*, Vol. CI, No. 2614, p. 109. London, February 4, 1916.

Much uncertainty still exists as to the time required before the forms can be removed from reinforced and other concrete works, and loads applied with safety.

With a view to contributing to the solution of the problem, Mr. A. B. MAC DANIEL has made some interesting experiments at the Engineering Experiment Station of the University of Illinois in order to test the effect of temperature on the rate of increase in strength in concrete.

For this purpose over 150 cubes and cylinders of concrete were made and stored at mean temperatures ranging from 26.5° to 90.6° Fahrenheit and tested after intervals of from 3 to 28 days. The concrete used was 1 part by weight " Universal " Portland cement with 2 parts sand and 4 parts crushed limestone, corresponding to 1 : 2.2 : 3.6 by volume.

The moulds were 6 inch cubes or cylinders 6 in. in diameter and 6 in. long or 8. in. in diameter and 16 in. long.

Some of the specimens were moulded at the temperature at which they were to be stored, most of them, however, were moulded in the laboratory and taken to the storage rooms after setting for 6 hours. In all cases they were kept moist. The figures obtained for the cubes were multiplied by 0.73 to make them comparable with the data obtained for the long cylinders.

At low temperatures the strength was found to increase slowly, provided the specimens were not alternately frozen and thawed, as this caused disintegration. At ordinary and comparatively high temperatures, higher crushing stresses were reached in a given time and generally the stress seems to increase with the storage temperature.

The average stresses obtained with specimens stored at a mean temperature of 48.5° F. were 800 lb., 1130 lb. and 1410 lb. per square in. respectively after 7, 14 and 28 days, while for a set stored at 72.8° F. the figures were 880, 1210 and 1530 lb. per sq. in. for the same periods.

As a result of these experiments Mr Mac Daniel concludes that for concrete hardening at from 60 to 70° F. the ratios of strength at 7, 14 and 21 days to the strength at 28 days may be taken as about 0.5, 0.75 and 0.9 respectively. The ratios are higher for high temperatures and lower for low temperatures. The actual strength of concrete after 1 week at a temperature of 60 to 70° F. would be practically double that of the same material kept at from 32 to 40° F.

(1) See also R. CAPPELLI and A. BRUTTINI. I serbatoi Cappelli in *Bollettino della Società degli Agricoltori Italiani*, XVth Year, No. 2, Rome, January 31. 1910.

A diagram accompanying the article gives, with a fair degree of approximation, the strength attained by concrete kept at temperatures between 15 and 90° F. for periods ranging from 3 to 28 days.

435 - **Extensive Use of Silos in Kansas, U. S. A.** — NICHOLS, J. B., in *The Country Gentleman*, Vol. LXXXI, No. 3, p. 108. Philadelphia, Jan. 15, 1916.

There are now more than 10 000 silos in the State of Kansas ; in 1909 there were only 160. The leading silo counties are in the most prosperous sections. For example, Sedgwick, an especially rich county, has the lead with 372 silos, Reno comes next with 333 while Lyon and Summer have 273 each. The greatest percentages of increase are found in the western counties. For example, the gain in Meade County in 1914 was 600 per cent ; Barton 336 ; Rooks 244 ; Clark 216 ; Pratt 144 ; and Ford 142 per cent. This rapid increase is due largely to the activity of the State Experiment Station, which has demonstrated that silage from sorghum and kafir corn has a high a feeding value as that from maize. For instance, the average yield of Kansas orange sorghum at the Station farm at Manhattan for the last two years has been 18 tons an acre. Fields of 12 to 15 tons an acre of sorghum and kafir corn in the eastern part of the State are common ; in almost all cases these yields are much larger than those of corn. The average yield decreases as one goes westward, but good yields of silage are produced from the sorghum most years as far west as the Colorado line.

An even greater increase in silo building is expected in the future.

## RURAL ECONOMICS.

436 - **Cash-renting and Share-renting in Missouri, United States.** — JOHNSON O. R., in *The Country Gentleman*, Vol. LXXXI, p. 18. Philadelphia, January 1 1916. RURAL ECONOMICS

In a farm management survey made in North western Missouri, figures gathered on the 669 farms showed that the average share tenant made $ 138 greater net income than the cash tenant, and that a share of the crop paid the landowner 1.3 per cent higher interest on his investment than was received by the owner who rented for cash.

The following averages were obtained :

*a*) the total net income of the average tenant who rented all his land on a share basis was $ 548, the owner receiving 4.9 per cent ;

*b*) the average cash renter made $ 410 and paid a rental that returned 3.6 per cent to the owner ;

*c*) the tenant who rented his crop land for a share and his grassland for cash made a net income of $ 507 ; the owner received 5.9 per cent on his investment.

437 - **Labor Income in Minnesota, United States.** — *The Country Gentleman*, Vol. LXXXI, N. 1, p. 18. Philadelphia, January 1, 1916.

In Rice Country, Minnesota, records were taken from 400 farms in order to determine the relation between the numer of units of labor on a farm and the labor income.

A unit of labor consists of ten hours of man labor or twenty hours of horse labor.

Labor income is the amount earned by a farmer in excess of the value of the farm produce used by his household, and of farm expenses and interest on the investment at five per cent.

Dividing the 400 farms into groups according to the number of their units of labor, we have : for the first group of farms with less than 200 units of labor, a labor income of $ 97 ; for the second group of farms with from 401 to 600 units of labor, a labor income of $ 267 ; for the third group of farms with more than 1,000 units of labor, a labor income of $ 605.

The efficiency of man labor is even more important than the amount of time expended.

The labor income gradually increased from $ 5, where the hours of each man for a year were 1500 or less, to $ 633, where the hours of each man were more than 3500 each year.

The above results indicates that a farm business of more than average size gives opportunity for high efficiency of man and horse labor, and a farm business of more than average size coupled with high labor efficiency brings profits in farming.

438 - **Advantage of Diversity in Farming Operations in the Central Wheat Belt in Kansas,** U. S. A. — JOHNSON E. C. in *The Breeder's Gazette*, Vol. LXVIII, N. 27, p. 1251. Chicago, December 30 1916.

At the initiative of the Harvey Co., Kans., Farm Bureau, surveys were made on 70 farms in Macon township, a typical wheat section of the country, by P. E. Mc Nall and County Agent F. P. Lane, in order to determine the influence of the high price of wheat on the farmers' labor income, and to ascertain whether the high prices quoted in the Chicago market ($ 1.65 a bushel in Feb. 1915) were due to the farmers holding their wheat to secure extortionate prices.

Regarding the second item, the survey has shown that in September 1914, 82 per cent of the wheat crop had already been sold at the average price of 90 cents per bushel, that is 12 cents more per bushel than the average received for wheat in this section for the last 10 years, not including 1914. This, together with the exceptionally large yield of 26.2 bushels per acre, as compared with an average yield for Harvey county for the last 10 years of 15 bushels per acre, made it possible for the wheat farmer to realize a high labor income for 1914.

The average farmer in the comunity made a labor income of $ 1556 and, in addition, realized 5 per cent interest on a capital of $ 22 731. If these farmers, however, had produced a yield of only 15 bushels per acre and had received 78 cents per bushel, which were the average yield and price for this area for the last 10 years, their labor income would have been only $ 451 per farm.

The income of the 15 better-paying farms amounted to 5 per cent interest on an investment of $ 28 602 and, in addition, a labor income of $ 3117 per year ; these farms growing an average of 138.2 acres of wheat with an average yield of 26.2 bushels per acre.

On 11 of the better-paying farms, however, receipts from cattle averaged $ 671 ; on 8 of the farms receipts from swine $ 1007, and on 7 farms dairy receipts amounted to $ 514, so that all this income must not be credited to wheat.

In fact, the 15 better-paying farms had 3.7 enterprises per farm which returned over $ 200 per enterprise, while the average farm in the section had only 2.7 enterprises which returned over $ 200 per enterprise. This is a strong argument for diversity in the farming operations, even during a year of unusual yield of wheat and when the price is above the average.

439 – **Cultivation of the Bamboo as a Profitable Commercial Enterprise.** — GIRARDI G., in *Bollettino della Società Orticola Varesina*, Year III, No. 28, pp. 5-8 ; No. 29, pp. 5-8 ; No. 30, pp. 5-8 ; No. 31, pp. 5-8. Varese, January 1916.

Data from experiments made by, or under the control of, planters in Tunis. The same data are confirmed in Japanese publications dealing with the bamboo as a plant of economic importance.

The following is an account of the average expenses and receipts for a plantation of 1000 plants, occupying an area of practically 1 acre ; the period covered is 10 years and no account is taken of interest :

*Expenses.*

| | £ s. d. |
|---|---|
| Buying of plot of ordinary land, about 1 acre | 29. 14. 9 |
| » 1000 bamboo plants of various types | 31. 14. 5 |
| Transplantation and manuring | 19. 16. 6 |
| Various unforeseen expenses | 5. 19. |
| Taxes, 10 years | 5. 19. |
| Harvesting the stems of the 4th and 10th years growth | 23. 15. 9 |
| Total expenses | 116. 19. 5 |

*Receipts.*

| | | | | £ s. d. |
|---|---|---|---|---|
| Crop of | 4 000 stems in | 4th year, at 6*s* 4*d* per 100 (1) | | 12. 13. 4 |
| » | 6 000 » | 5th » » | | 19 |
| » | 9 000 » | 6th » » | | 28. 10. |
| » | 12 000 » | 7th » » | | 38 |
| » | 15 000 » | 8th » » | | 47. 10. |
| » | 18 000 » | 9th » » | | 57 |
| » | 21 000 » | 10th » » | | 66. 10. |
| | 3 000 extra strong canes exceeding 2 inches in diameter, at £2. 7. 6 per 100 | | | 71. 5. |
| | | | Total receipts | 340. 8. 4 |

(1) The minimum price paid to growers is really 7*s* 11*d*. per 100.

The bamboo stems sold by the big grower should be some 16 feet long; picked stems averaging 19 ½ to 29 ½ feet in length. There then remain the tops for which there is considerable demand among horticulturists and basket manufacturers who are prepared to pay them 1*s.* 7*d.* to 4*s.* 9*d.* per 100, according to the diameter. Including this secondary product therefore, a plantation may be said to produce, between the 4th and 10th year, nearly £ 1000 worth of stems.

According to the price lists of the chief French firms exporting bamboo stems the average retail prices for canes of various lengths are as follows :

| Length | Width | Price per 100 |
|---|---|---|
| metres | millimetres | £ *s.* *d.* |
| 0.60 | 6 | 1. 5 |
| 0.90 | 6-8 | 1. 7 |
| 1.10 | 6-8 | 2. 0 |
| 1.20 | 8-10 | 2. 9 |
| 1.30 | 10-12 | 3. 6 |
| 1.50 | 12-15 | 99. 6 |
| 1.50 | 18-22 | 17. 5 |
| 2.00 | 12-15 | 11. 1 |
| 2.00 | 18-22 | 19. 10 |
| 3.50 | 35-55 | 3. 19. 4 |

On the basis of these prices, the writer calculates that in the estimation of the value of the bamboos produced by a plantation the standard price of 6*s.* 4*d.* per 100 only represents $^1/_{10}{}^{th}$ of the real value for the retail trade seeing that what are considered as picked stems by this latter are at least 30 to 40 mms. in diameter (1 $^1/_5$ to 1 $^3/_5$ inches). This is additional evidence in favour of the cultivation of this crop in uncultivated soils whether of plain, hill or mountain.

440 – **Cost of Running a Peach Orchard in North Carolina, U. S. A.** — Page A. W., in *The Country Gentleman*, Vol. LXXX, No. 47, pp. 1750 and 1772. Philadelphia, Nov. 20 1915.

The farmers of Moore County, North Carolina, have established an organisation, known as the Sandhill Board of Trade, the chief object of which is to ascertain exact facts and conditions, and profits and losses on all the farms and crops in the territory. The carefully tabulated information gained by this society is of real and practical value to the whole country.

The present writer takes as an example the case of peach growing such as it appears from an examination of the books of the Carolina Fruit Company, a little ninety-acre orchard which may be regarded as typical. It was planted in 1907 on land cleared of scrub oak and pine stumps.

The receipts and expenses of the Company, from its beginning until Sept. 1, 1910, when the first small crop of peaches was sold, were as follows:

TABLE I. — *Statement for the Period Jan.* 1, 1907 *to Sept.* 1, 1910.

*Receipts*: 1907 *to September* 1 1910.

| | |
|---|---|
| Capital stock: | |
| Issued for cash | $ 12 620.00 |
| Issued to promoter | 1 250.00 |
| | $ 13 870.00 |
| Cotton grown on an acre in 1909 | 53.82 |
| Cowpeas grown between trees | 176.00 |
| Corn sold | 3.30 |
| Interest in idle money invested | 40.28 |
| Owed open account | 161.23 |
| Peaches sold, 1910 | 2 403.26 |
| | $ 16 707.89 |

*Disbursements*: 1907 *to September* 1, 1910.

| | |
|---|---|
| 140 acres of wild land | $ 845.00 |
| Building: 7-room house, 4-mule barn, shed and tenant house | 1 214.96 |
| 1700 peach trees | 884.85 |
| Fence | 66.45 |
| Well | 141.50 |
| Total labor bill, including clearing land | 4 509.31 |
| Fertilizer for 3 ½ years, including all crops | 2 007.88 |
| Seed. — corn, cotton, peas, etc. | 70.05 |
| Pair mules and harness | 358.45 |
| Machinery, total | 484.95 |
| Feed for mules | 763.19 |
| Crates for peaches | 236.68 |
| Spraying material | 421.96 |
| Taxes | 167.05 |
| Legal expense, incorporating, etc. | 150.95 |
| Office expense, including auditor and travelling | 516.19 |
| Exchange on checks | 82 |
| Freight on peaches | 301.05 |
| Salary paid superintendent | 1 760.00 |
| Insurance | 30.00 |
| General expense, small miscellaneous items | 180.68 |
| In superintendent's hands. Spent but not accounted for | 299.16 |
| Money loaned | 32.23 |
| Profit and loss | 54.53 |
| Promoter's bonus | 1,250.00 |
| | $ 16 707.89 |

TABLE II. — *Statement for the 4 years' working* 1911-1912-1913-1914

| | 1911 | 1912 | 1913 | 1914 |
|---|---|---|---|---|
| INCOME. | | | | |
| 1911 Peaches . . . . . $4,079.52 | | | | |
| Mortgage . . . . . 2,028.99 | | | | |
| Bills payable . . . . . 1,990.00 | $8 098.51 | | | |
| 1912 Peaches . . . . . | — | $10,431.69 | | |
| 1913 Peaches . . . . . | — | — | $15,130.90 | |
| 1914 Peaches . . . . . | — | — | — | $13,460.02 |
| EXPENSES. | | | | |
| Mortgage and interest . . . . . | $2,132.99 | — | — | — |
| Taxes . . . . . | 17.24 | $28.70 | $42.01 | $126.56 |
| Bills receivable . . . . . | 66.00 | — | — | — |
| Interest, less discount . . . . . | — | 78.15 | 62.10 | 129.70 |
| Legal fees . . . . . | 6.00 | — | — | — |
| Fire insurance . . . . . | — | 41.93 | — | 32.00 |
| Superintendent's salary . . . . . | 720.00 | 480.00 | 480.00 | 1,080.00 |
| Freight, expressage, telegrams, and telephone service . . . . . | 195.00 | 284.59 | 11.59 | 53.39 |
| Crates . . . . . | 695.25 | 2,081.77 | 1,075.50 | 1,688.00 |
| Labor . . . . . | 1,375.08 | 3,221.64 | 3,206.08 | 3,954.36 |
| Repairs, additional tools, etc. . . . . | 478.81 | 387.11 | 147.91 | 95.09 |
| Sundry supplies . . . . . | 165.34 | 138.57 | 56.93 | 83.11 |
| Fodder, grain, etc. . . . . | 47.05 | 219.46 | 216.52 | 240.24 |
| Superintendent, to account . . . . . | 97.48 | — | — | — |
| Charged proportion of cost of packing house | — | 200.00 | 300.00 | — |
| Fruit trees . . . . . | — | 87.07 | 53.03 | — |
| Seeds . . . . . | 27.12 | 33.75 | 12.90 | 64.90 |
| Fertilizer . . . . . | 776.00 | 591.00 | 949.51 | 875.70 |
| Spraying material . . . . . | 160.11 | 225.11 | 289.32 | 280.19 |
| Printing, stationery, postage, etc. . . . . | — | — | 25.10 | 32.18 |
| Bookkeeper and auditor . . . . . | 224.50 | — | 80.00 | 240.00 |
| Depreciation on buildings . . . . . | 131.09 | — | — | 193.15 |
| Depreciation on machinery, etc. . . . . | — | — | — | 113.80 |
| Cash on hand . . . . . | 783.45 | — | — | — |
| | $8,098.51 | $8,098.85 | $7,008.50 | $9,282.37 |
| Balance, net profit on operations. . . | | 2,332.84 | 8,122.30 | 4,277.65 |
| | $8,098.51 | $10,431.69 | $15,130.80 | $13,560.02 |

TABLE III. — *Balance Sheet for 4 years' Working* 1911-1912-1913-1914.

| | | 1911 | 1912 | 1913 | 1914 |
|---|---|---|---|---|---|
| ASSETS. | | | | | |
| Land and trees | | | $11,800.00 | $11,800.00 | $13,530.00 |
| Buildings | | | 2,124.13 | 1,824.13 | 1,738.50 |
| Engines, implements, etc. | | | 770.00 | 856.19 | 1,024.60 |
| Mules | | | 750.00 | 550.00 | 1,050.00 |
| Stock of spraying material | | | 156.00 | 50.00 | 75.00 |
| Cash on hand | | | 1,094.29 | 965.93 | 338.25 |
| Mortgage | | | 97.70 | 92.70 | — |
| Accounts due company | | | 1,575.10 | — | 24.50 |
| Treasury stock, 100 shares | | | — | — | 1,000.00 |
| Crates on hand | | | 496.00 | 300.00 | 510.00 |
| Fertilizers on hand | | | 51.00 | 50.00 | — |
| Cost of clearing new land | | | — | — | 193.00 |
| Cost of new water service | | | — | — | 229.94 |
| | | $15,860.00 | $18,914.22 | $16,488.95 | $19,713.79 |
| LIABILITIES. | | | | | |
| Capital stock | | $13,870.00 | $14,070.00 | $14,070.00 | $17,530.00 |
| Bills payable | | 1,990.00 | 1,700.00 | — | — |
| Accounts payable | | — | 268.29 | — | — |
| Superintendent, balance | | — | — | 429.48 | — |
| Surplus, 1912 | | — | 2,875.93 | — | — |
| Profit and loss account, 1913: | | | | | |
| Surplus 1912 | $2,875.93 | | | | |
| Less superintendent's share of profit, $583.21, and sundry adjustments, $64.37 | 646.68 | | | | |
| | $2,229.25 | | | | |
| Profit 1913, $8,122.30 Superintendent's share $2.030.58. | 6,091.72 | | | | |
| | $8,320.97 | | | | |
| Dividend 1913, 45% | 6,331.50 | | | | |
| Surplus | $1,989.47 | — | — | 1,989.47 | — |
| Profit and loss account, 1914 | 1,989.47 | | | | |
| Balance, 1913, less half amount of stock issued to superintendent | 1,737.00 | | | | |
| | 252.47 | | | | |
| Add sundry adjustments | 33.17 | | | | |
| | $285.64 | | | | |
| Profit and dividend, treasury stock | 250.00 | | | | |
| Profit, season 1914 | 4,277.65 | | | | |
| | $4,813.29 | | | | |
| Dividend, 1914, 15% | 2,629.50 | | | | |
| | $2,183.79 | — | — | — | 2,183.79 |
| | | $15,860.00 | $18,914,22 | $16,488.95 | $19,713.79 |

Success has been almost entirely due to the superintendent whose interest was obtainable only on the condition that he be given a fifth share in the orchard at the end of four year's work. As a result of the payment of this interest the capital stock of the Company has been increased to $ 17 530.

Out of the profits as shown in the accompanying balance sheets the company has also planted 25 acres of new trees, has built a big packing house costing $ 1 400, bought a new pair of mules, installed a water system and added a larger spraying outfit.

441 – **The Practical Balance for a Successful Dairy Farm in the United States.** — WARREN, G. F., in *Hoard's Dairyman*, pp. 710, 731, 733. Fort Atkinson, Wisc., Dec. 24, 1915.

In ordinary dairy-farming practice some of the most important factors for success are the size and diversity of the business, the crop yields and the receipts per cow. Each of these problems involves many others. For example, good receipts per cow involve the quality of the cow, the method of feeding and management and the marketing of the product. But another factor of more general character and of specific importance in the organisation of every agricultural enterprise is that of the distribution of the work during the year in such a way as to make the very best use of the labour at the disposal of the farm. In agriculture, as in all other manual occupations, a full year's work is normally necessary to make it profitable.

Enough facts about farming are now available to give us a knowledge of how much work it takes to make a full year. Cost accounts on many farms show that the entire care of a dairy cow, except raising the feed, requires 140 to 150 hours per year. Sometimes the work is done in 100 hours.

Most successful farmers work about 2 500 to 3 000 hours in a year. If this is called a year's work, it would require 20 to 25 cows to provide a full employment for one man. The writer has indeed actually visited several farms where one man does milk and care for 25 cows, but obviously such a plan is not practical. However, it is practical to have two men care for this number of cows and spend half their time at other work.

In order to compare farms and thereby learn what factors contribute to making a good profit, we must have some standard of comparison. Labour income, or the wages that the farmer makes for himself is the best means of comparison. To obtain the farmer's labour income all farm expenses are subtracted from the farm receipts. The difference represents the amount that the former and his money earned. Subtracting interest on the capital at 5 per cent, we get the labour income.

If some member of the family other than the operator helps with the farm work and does not receive wages, the amount that it would cost to hire this work is called an expense.

The writer then proceeds briefly to examine the influence of the 3 chief factors: size of the farm, dairying combined with the crop production, and the milk yield of each cow, on the labour income of the owner.

*Size of farm.* — In the case of 142 farms in the county of St. Lawrence, New York, attention has been paid to the influence on the labour income,

of both the total number of cows and the milk production of each. In this locality dairying is the only important industry ; 80 per cent of the receipts come from the sale of dairy cattle and milk.

Good pastures are available, but not much good land is available for raising crops for sale. The only important crops are hay, maize for the silo, and oats. Practically all the grain feed for cows is purchased. Under such conditions, it is evident that the number of cows kept is a good measure of the size of the business. The results for the 142 farms are set out in Table I.

TABLE I. — *Relation of Number of Cows to Labour Income in a Region Selling little but Dairy Products.*

| Number of cows | Milk sold per cow | | |
|---|---|---|---|
| | $ 70 or less | $ 71 - $ 85 | Over $ 85 |
| | Labour Income | Labour Income | Labour Income |
| Less than 20 . . . | $ 360 | $ 487 | $ 457 |
| 20 to 30. . . . . | 397 | 780 | 1 152 |
| Over. . . . . | 630 | 922 | 1 774 |

As will be seen from the table, the farmers who have less than a two-man farm, that is, less than 20 cows, are on the average not making more than a hired man's wages. But those who have more cows are doing well.

Table II shows the relation of the size of farms to profits on 579 farms in Livingston county, New York. This a grain growing, general farming and dairy region.

TABLE II. — *Relation of Size of Farm to Labour Income in a Region that Combines Dairying with Cash Crops.*

| Acres Farmed | No. of farms | Average area | Average tillable area | Labour income |
|---|---|---|---|---|
| 30 or less . . . . . | 17 | 20 | 17 | $ 54 |
| 31–50. . . . . | 35 | 43 | 37 | 295 |
| 51–100 . . . . . | 147 | 79 | 64 | 437 |
| 101–150 . . . . . | 178 | 127 | 104 | 593 |
| 151–200. . . . . | 89 | 175 | 142 | 934 |
| Over 200 . . . . . | 112 | 305 | 241 | 1 082 |

The results indicate that, on the average, in this region about 150 to 200 acres are required for a very successful farm. Of course, some smaller farms are successful, but evidently they are working at a disadvantage. The larger farms are better equipped with horses and machinery, but neither of these costs so much per acre as on the small places. One horse is sufficient for 20 to 30 acres of general farm crops. If one is to make the great saving in human labour that comes from driving three and four horse teams, he evidently needs 80 or more acres of crops to keep the horses busy. A mixed farm requires for other reasons another one or two horses, but in order to obviate over-working of the two labourers available the number of cows should be reduced to between 10 and 20. In most dairy regions in the United States this means a 160 acre farm; the remaining 80 acres being used for pasture, woods, roads and farmstead.

Several years ago, an agricultural journal made a study of farms operated by its subscribers. These farms averaged 167 acres and grew 95 acres of crops per farm besides pasture and woods. These farms kept an average of 16 cows and 6 horses. They are much larger than the average farm and make labor incomes much larger than the average farmer makes.

In the irrigated zone of Logan, Utah, instead of two or three acres being required to pasture one cow, as is the usual average in dairy regions, the rich soil and abundance of water make it possible to pasture two and sometimes three cows on one acre. Alfalfa gives large yields per acre. Sugar beets are the important cash crop. Under these unusual conditions a farm of 50 acres may be as large a business as 160 acres is in some other regions.

TABLE III. — *Relation of Receipts per Cow and Cash Crops to Profits on 585 Farms with 6 or more Cows, Jefferson County New York.*

| Per cent. of receipts from Crops | Receipts per Cow from Milk and Its Products | | |
|---|---|---|---|
| | $ 50 or less | $ 51 - $ 75 | Over $ 75 |
| | Labour income | Labour income | Labour income |
| No crops sold . . . . . | $ 56 | $ 572 | $ 926 |
| 1–20 . . . . . | 311 | 589 | 962 |
| 21–50 . . . . . | 426 | 947 | 1 183 |
| 41–60 . . . . . | 554 | 1 366 | * |
| Over 60 . . . . . | 599 | * | ** |

* Only 2 farms in this group.
** No farms in this group.

*Diversified and Specialised Dairy Farms.* — Table III shows that dairymen who derive at least a part of the income from the sale of cash crops

TABLE IV. — *Distribution of Man Labour (hours) on a Dairy Farm.*

| Type of work | January | February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stable of 42 cows: 1 bull, 10 heifers | 625 | 470 | 497 | 528 | 433 | 350 | 368 | 303 | 294 | 303 | 372 | 519 |
| 9 Horses | 37 | 23 | 50 | 45 | 64 | 55 | 37 | 31 | 37 | 50 | 23 | 31 |
| Manure | 31 | 56 | 23 | 45 | 42 | — | 37 | 92 | 60 | 31 | 56 | 37 |
| Potatoes 1912 | — | 50 | 193 | — | — | — | — | — | — | — | — | — |
| Potatoes 10.7 acres | — | — | — | 45 | 225 | 170 | 101 | 18 | — | 221 | — | — |
| Maize 19.2 acres | — | — | — | 147 | 14 | 105 | 92 | 36 | 184 | 27 | — | — |
| Oats 43.8 acres | — | — | — | 110 | 110 | — | 23 | 276 | — | 266 | — | — |
| Oats 1914 | — | — | — | — | — | — | — | — | — | — | 73 | — |
| Wheat 1914 | — | — | — | — | — | — | — | 55 | 73 | — | — | — |
| Hay 101.7 acres | — | — | — | 294 | — | — | 778 | — | — | — | — | — |
| Alfalfa 4.6 acres | — | — | — | — | 18 | 55 | — | — | — | — | — | — |
| Cabbage 6.7 acres | — | — | — | — | 23 | 165 | 18 | 60 | 18 | 119 | 23 | — |
| Poultry 188 head | 14 | 14 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 14 |
| Farm | 14 | — | — | 18 | 119 | 193 | 64 | 138 | 221 | 55 | — | — |
| Staff | 14 | 70 | 175 | 56 | 74 | 96 | 83 | — | — | — | — | 23 |
| Equipment | — | — | — | — | — | — | 31 | — | 60 | 18 | 18 | — |

make much more than do those who sell nothing but dairy products. There are many reasons why it pays to combine crops with dairy farming. One reason is that two men can milk 15 to 20 cows and yet have half the day for field work. This is more time available than is necessary to raise the feed for the cows. The horses kept on the farm also have time to raise other crops than feed.

Another reason why such crops help is that the manure is much more effective when spread over more land than when it is all used on the area that raises feed for the cows.

This point is well illustrated by a test continuing for 21 years at the Ohio Experiment Station. When 4 tons of manure were applied per acre every 3 years, each ton of manure gave increased crops worth $ 3.49 per ton. But when twice as much manure was applied on the same land, the additional amount gave crops worth only $ 1.95 per ton of additional manure.

The dairyman is particularly fortunate if he can combine some high priced crop with dairy farming. In some States, fruit, potatoes, tobacco or cabbages are very profitable crops to combine with dairying. In irrigated regions sugar beets are commonly grown on dairy farms. All such intensive crops give a very large return for manure.

In the maize belt one of the most profitable systems of farming is the combination of dairying and hog raising.

There are many reasons why at least some cattle should be kept. Cattle use up products that would have little value on the market, such as straw, stalks and low grade hay. Perhaps the point of most importance is that they provide for a full day's and for a full year's work.

Table IV shows the annual distribution of man labour for a dairy farm giving excellent profits.

The labour is supplied by 3 men occupied the whole year round, with temporary outside help at harvest time. The dairy herd averages about 40 cows and 187 acres of crops are grown. The cash crops are the best ones for the region : potatoes, cabbage, timothy hay. The combination makes a very efficient business.

*Milk yield of individual cows.* — The importance of good returns per cow is shown in Table V, which gives results for 585 farms in Jefferson County. They are divided into 5 classes according to the average yield per cow.

Similar figures have also been obtained from several other dairy regions.

The principal problem in the organisation of a dairy farm consists in establishing a perfect balance between the 3 factors mentioned for each particular region. This being so, what is required is a careful examination of each of these factors in order to determine which of their number is capable of modification in order to obtain the best results.

The method of procedure for this analysis is exemplified in Table VI.

TABLE V. — *Relation of Receipts per Cow from Milk and its Products to Profits on 585 Farms with 6 or more Cows in Jefferson County, New York.*

| Receipts per cow | Average receipts per cow | Number of farms | Labour income |
|---|---|---|---|
| $ 30 or less . . . . . | $ 22 | 45 | $ 241 |
| $ 31 – $ 50 . . . . . | 42 | 178 | 394 |
| $ 51 – $ 75 . . . . . | 63 | 221 | 764 |
| $ 76 – $ 100 . . . . . | 86 | 111 | 909 |
| Over $ 100 . . . . . | 119 | 39 | 1 307 |

TABLE VI. — *Relation of Various Factors to Profits,*

| | Farm No. 1 | Farm No. 2 | Farm No. 3 |
|---|---|---|---|
| Area in acres . . . . . | 52 | 250 | 250 |
| Acres of crops . . . . . | 29 | 133 | 109 |
| Number of cows . . . . . | 11 | 20 | 32 |
| Receipts per cows . . . . . | $ 116 | $ 95 | $ 56 |
| Crop yields in relation to the average of the locality . . . . . | double | 3/4 | 1/4 |
| Percentage of receipts that come from crops. | 21% | 16% | 4% |
| Labour income . . . . . | $ 980 | $ 1661 | — $ 113 |

As seen above, N° 1 is a very well balanced farm but is too small. The weak points in N° 2 are the crop yields. A neighbour who had all the factors almost exactly the same, except that he had good crops, made a labour income of $ 2239. In the case of Farm III the owner had nothing left as pay for his year's labour, yet he raised very much better crops than his neighbour, N° 2, and kept more cows. His weak spot is in the returns per cow. If these were as good as on Farm N° 2 this farmer should make at least $ 1500.

442 – **Profits and Loss in the Dairy Business of Chemung County, New York, United States.** — CHUBBUCK M. E., in *American Agriculturist*, Vol. 96, No. 25, pp. 9, New York, December 18, 1915.

The Chemung County Farm Bureau has published the results of a careful research in order to ascertain the profits and loss in the dairy business of the County. The following points were determined:

*a*) The feed cost of cows on each farm;

*b*) The medium production per farm;

*c*) The relation between these two factors and the labor income of the farmer.

The results are summarised in the two following tables ; the first of which gives the average results for the whole County, and therefore comprises hill and valley farms, while the second gives those of 115 valley farms. In each table the farms are divided into 5 groups according to the average cash returns per cow.

TABLE I. — *Cost of feed per cow in Chemung County.*

| Gross receipts for milk and butter per cow | Feed raised | Feed purchased | Total feed | Milk and butter receipts per cow | Profit above feed cost | Labor income (1) |
|---|---|---|---|---|---|---|
| $ 50 and less . . . . | $ 38 | $ 7 | $ 45 | $ 37 | $— 8 | $ 138 |
| $ 51 to $ 75 . . . . | 40 | 11 | 51 | 62 | 11 | 325 |
| $ 76 to $ 100 . . . | 44 | 16 | 60 | 87 | 27 | 496 |
| Over $ 100. . . . . | 48 | 18 | 68 | 119 | 53 | 921 |

TABLE II. — *Receipts per cow, 115 valley farms.*

| | | | | | | |
|---|---|---|---|---|---|---|
| $ 50 and less . . . . | $ 42 | $ 7 | $ 49 | $ 42 | $— 7 | $ 269 |
| $ 51 to $ 75 . . . . | 47 | 8 | 55 | 63 | 8 | 70 |
| $ 76 to $ 100 . . . | 53 | 15 | 68 | 87 | 19 | 747 |
| $ 101 to $ 125 . . . | 52 | 19 | 71 | 110 | 39 | 1,038 |
| Over $ 125. . . . . | 53 | 23 | 76 | 140 | 64 | 2,209 |

(1) The farmer's labor income is obtained by substracting from the gross profit the expenses and the interest of capital at 5 % ; the labor furnished by members of the farmer's family figures in the expenses and is estimated according to the equivalent local labor remuneration ; the farm produce taken for home use constitutes, on the other hand, a further benefit of the farmer besides the remuneration thus calculated for his personal labor and management.

The five groups of farms, classified according to the average cash returns per cow, show a series of clearly defined relations represented, in the first place, by the progressive increase of the farmer's labor income in proportion to the progressive increase of the average returns per cow ; by the increase of purchased feed in proportion to the increase of production of raised feed ; by the increase in production of raised feed in proportion to the increase of total feed consumed, with a constantly progressive relation to purchased feed, and a less constant one to feed raised on the farm. It may therefore be concluded that, though the labor income in the several groups of farms thus divided is the result of factors that may have influenced

it in various ways, the first place among these factors must in practice be given to the average production of the cows. This production necessarily depends more upon the quality of the cows employed and upon the quantity of purchased feed they eat than upon the increase in price of the forage raised and consumed on the farm. The great difference to be seen in the average produce of the cows in single farms, and in the farmer's labor income is chiefly due to the fact that in County Chemung there exists a strong cow-testing association, numbering 26 members, which has considerably raised the production on the farms belonging to members by eliminating the less productive cows.

In 1914, the average production of 278 cows was 6889 pounds of milk and 248 pounds of butter fat showing an average test of 3.6 %.

## AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

443 - **Methods of Testing Must.** — MENSI CARLO, in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLIX, No. 1, pp. 35-38. Modena, 1916.

The writer gives a short account of the principles upon which the GUYOT and BABO mustimeters are based and shows the errors which may arise from their use.

With regard to the tests of grapes and musts based on their sugar content, especially if this latter is determined by means of mustimeters, the writer observes that no account is taken of non-saccharine extractives, such as acids, colouring matters etc. which are of considerable commercial and organoleptic importance, as it is these extractives which give the wine its distinctive character and distinguish it definitely from a simple alcoholic solution.

In the analysis of musts, it is considered that the BABO mustimeter should be abandoned and one of the two following methods adopted instead :

1) *Densimeters* giving the specific gravity of the musts to the 3rd place of decimals. The specific gravity provides information of a more general type than that given by BABO's method ; by the aid of the tables of WINDISCH (or of others which may eventually replace these latter) it enables the quantity of substances dissolved in the musts to be calculated.

2) *Saccharometers*, also based on the tables of WINDISCH, giving the total quantity of substances dissolved in the musts and if necessary their density also.

Further, the composition of musts should be studied by more up-to-date methods than those now in use.

Six analyses of musts from the 1914 vintages show the practical application of the principles laid down by the writer.

444 – **The Milling of Rice and Its Mechanical and Chemical Effect upon the Grain.** – WISE, F. B. and BROOMWELL, A. W. (Office of Grain Standardisation and Food Control Laboratory) in *U. S. Department of Agriculture, Bulletin* No. 330, pp. 1-29, Fig. 1-5. Washington, D. C., January 8, 1916..

These investigations concern two types of rice which constitute the bulk of the rice crop grown in the United States, viz: Honduras rice, long and slender; and Japan rice, smaller and nearly round in shape.

*Mechanical effects of milling.* — No figures are available showing the breakage of rice in mortar and pestle mills. It is believed, however, that the breakage was small and that decline in use of these latter was due to other economic factors, such as their comparatively small output.

The "plantation huller", a machine for cleaning rice for local use causes great breakage, especially to rice of the Honduras type. The following table shows the effect of milling in the plantation huller on Honduras rice.

| Milling stage. | Grains per cent. | | | | |
|---|---|---|---|---|---|
| | Whole. | Three quarters. | One half. | One third. | Less than one third. |
| After first hulling . . . . . | 32.0 | 12.7 | 44.1 | 7.0 | 4.2 |
| Finished product . . . . . | 9.6 | 8.8 | 38.8 | 24.8 | 18.0 |

The effect of modern rice milling machinery is shown in the following figures for the mechanical analysis of 56 series of samples of Honduras rice and 25 samples of Japan rice collected from modern mills in Louisiana, Texas and Arkansas.

| Milling stage. | Honduras rice number of grains per cent. | | | | | Japan rice number of grains per cent. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Whole. | Three fourths. | One half. | One third. | Less than one third. | Whole. | Three fourths. | One half. | One third. | Less than one third. |
| Paddy machine . . . . | 74.35 | 8.76 | 15.33 | 1.16 | 0.40 | 92.38 | 2.38 | 4.38 | 0.65 | 0.21 |
| Hullers and pearling cone | 52.51 | 13.38 | 24.73 | 5.67 | 3.71 | 84.22 | 4.30 | 7.66 | 2.44 | 1.38 |
| Brush (polishing without talc etc.): in . . . . . | 49.96 | 13.56 | 25.51 | 6.54 | 4.43 | 80.37 | 4.89 | 8.54 | 3.83 | 2.37 |
| out . . . . | 52.57 | 14.62 | 26.28 | 5.11 | 1.42 | 82.52 | 4.84 | 8.96 | 2.88 | 0.80 |
| Trumbles (for coating in the glucose state). . . | 51.69 | 14.44 | 27.18 | 5.49 | 1.20 | 82.57 | 4.70 | 8.29 | 3.61 | 0.83 |

The five stages in the milling process at which these samples were taken are considered very significant. The first rice is from the paddy machine and shows the condition of the grain after the removal of its hull between the stones and the separation of the remaining portion of rough rice. This, then, is brown rice retaining the bran coat and germ nearly intact. Naturally, the percentage of whole grains is comparatively large, but it is found that badly sun-cracked rice often shows a considerable amount of breakage even at this stage.

The next stage is concerned with the removal of the bran in the " huller " and pearling cone. The severe scouring to which the grain is subjected is shown in marked decrease in the percentage of whole grains. It is at this stage that most of the breakage in rice milling occurs.

The brush is the polishing machine for the removal of the finer particles of bran. This causes a very slight reduction in the percentage of whole grains, which is recovered in the reeling process, by the removal of the smaller fractions, as brewer's rice.

The final stage concerns the rolling and heating after the application of a coating of glucose and talc. A slight breakage also occurs here due to changes of temperature.

Corresponding to the decrease in the number of whole grains there is also a gradual decrease in the weight per 1000 grains during the milling process.

*Chemical Effet.* — The product from the " plantation huller " is lower in percentage of ash, ether extract and crude fibre than the rice from the old mortar-and pestle mills, indicating a more thorough scouring of the grains in the huller. The changes in percentage composition are still greater in rice milled by modern machinery.

The ash content is reduced very markedly when the hulls are removed and one half of the ash which remains is removed by the scouring work of the hullers. During the remainder of the process the decrease is gradual. The total loss by the cleaning and polishing process (from paddy machine to trumbles) is 66 per cent or $^2/_3$ of the total ash of the hulled rice. The percentage of fat or ether extract is generally increased by the removal of the hulls unless the stones are not properly adjusted so that some of the germ becomes removed. More than 75 per cent of the fat content of the hulled grain is removed in the hullers and the total loss of fat from the finished rice is 85 per cent.

With regard to the crude fibre content, 88 per cent is removed with the hulls and 73 per cent of the remainder during the scouring processes.

Only 10 per cent of the protein content of the hulled grain is removed in the scouring, showing that the aleurone layer is not removed.

Approximately 60 per cent of the pentosans is removed with the hulls and 32 per cent of the remainder during the scouring process.

These changes in chemical composition are much the same in both Japan and Honduras rice.

*Commercial products.* — Milled rice is graded according to the percentage of whole grains and the size of the particles. Thus Honduras

rice is marketed in four grades: 1) *Fancy head* or "*Head*" rice containing about 80 per cent of whole grain and yielding about 59 lbs. per barrel of rough rice; 2. *Second head*, consisting of broken grains yielding 19 lbs. per barrel; 3) *sereenings*; and 4) *brewer's rice* yielding respectively 1 and 8 lbs.

*Effect of Milling on the Chemical Composition of Rice.*

| Milling stage | Moisture | Ash | Ether extract | Crude fibre | Protein | Pentosan |
|---|---|---|---|---|---|---|
| | per cent | per cent | per cent | per cent | per cent | per cent |
| *Honduras Rice:* | | | | | | |
| Rough Rice | 11.27 | 5.40 | 1.58 | 8.67 | 7.48 | 5.90 |
| Rice from paddy machine | 12.32 | 1.18 | 1.79 | 0.99 | 8.57 | 2.42 |
| » » hullers | 12.56 | 0.53 | 0.40 | 0.39 | 7.79 | 1.90 |
| » » pearling cone | 12.50 | 0.47 | 0.28 | 0.30 | 7.88 | 1.53 |
| » » brush | 11.89 | 0.30 | 0.25 | 0.30 | 8.06 | 1.80 |
| » » trumble | 12.02 | 0.40 | 0.21 | 0.26 | 7.75 | 1.66 |
| Total loss in dry matter | — | 60.00 | 85.00 | 73.00 | 10.00 | 32.00 |
| *Japan Rice:* | | | | | | |
| Rough rice | 11.05 | 5.14 | 1.74 | 7.93 | 6.50 | 5.48 |
| Rice from paddy machine | 12.38 | 1.13 | 1.52 | 0.85 | 7.24 | 2.28 |
| » » hullers | 13.70 | 9.70 | 0.66 | 0.42 | 6.82 | 1.76 |
| » » pearling cone | 13.38 | 0.40 | 0.31 | 0.29 | 6.59 | 1.60 |
| » » brush | 12.82 | 0.32 | 0.22 | 0.29 | 6.61 | 1.68 |
| » » trumble | 12.50 | 0.34 | 0.19 | 0.29 | 6.47 | 1.68 |
| Total loss in dry matter | — | 70.00 | 87.00 | 66.00 | 12.00 | 26.00 |

Japan rice is marketed in 3 grades as follows: 1) *Fancy head* or "*head*", containing 90 per cent of whole grains and yielding 96 lbs. per barrel of rough rice; 2) *sereenings* and 3) *brewer's rice* each yielding 5 lbs. per barrel.

The mill yield of rice hulls approximates 30 lbs., that of rice bran 20 lbs. and that of rice polishings 6 lbs per barrel of rough rice.

Chemical analyses of the various commercial grades of rice show a slightly smaller percentage of ash, ether extract, and crude fibre in the higher than in the lower or more broken grades. The percentage of protein in the milled Honduras rice is somewhat higher than in the Japan rice.

Rice hulls contain but little ether extract or protein, but are very rich

in ash, crude fibre and pentosans. Bran and polishings are rich in fat and protein and when fresh and not adulterated with hulls are considered an excellent stock feed.

445 – **The Utilisation of the Residues of Oil Extraction from Olives.** — CHEVALIER H., in *Régence de Tunis, Bulletin de la Direction générale de l'Agriculture, du Commerce et de la Colonisation*, 19th Year, No. 85, pp. 277-283. Tunis, November-December 1915.

As a result of his research among the writings of such Latin writers as Cato, Varro etc. the writer has been able to identify the *margines* or *marchies* of French olive growers with the *amurca* of these ancients. Contrary to modern practice which usually disregards this by-product these writers advised its preservation and utilisation.

In order to preserve the *amurca* it is boiled on leaving the press, until its volume is reduced by one half, it is then put into vessels in the same way as oil and wine. The Latin agronomists were unanimous in recommending it as a *fertiliser* and as an *insecticide*. CATO recommended watering the foot of olives and sterile fig trees with *amurca* diluted in water. COLUMELLA and PALLADIUS gave similar advice, the latter recommending it in the " cooked " state for treating the roots of vines. For the control of the animal parasites of this latter plant and especially of *Pyralis*, CATO recommends the following method for its employment: after allowing the *amurca* to settle, concentrate to the consistence of honey, add ⅓ of powdered bitumen and ¼ of flowers of sulphur, and finally concentrate the whole to the consistency of glue. The product is then spread on the stock and branches. The same author also recommended the use of *amurca* for sheep scab, ants, weevils and parasitic mites, and spoke of its qualities as a preservative of skins, leather, wood, metal etc.

The neglect of this residue of the oil press by modern practice constitutes a considerable loss to agriculture. The olive may be regarded as yielding, by weight: ⅓ of oil (maximum) and ⅓ of cake; the remaining ⅓ may therefore be regarded as the quantity of " margines ". The quantity of this product wasted yearly in France may be calculated as 80 000 metric tons. The following analysis by M. BERTAINCHAND will serve as a basis for the estimation of lost fertilising matters:

1 *litre of "margines", density* 1150-1150 *contains in gms:*

| | | | |
|---|---|---|---|
| Mineral matter | 24.20 | Phosphoric acid | 0.39 |
| Potash | 12.43 | Chlorine | 2.52 |
| Soda | 0.36 | Nitrogenous matter | 3.98 |
| Lime | 0.78 | | |

The annual loss would thus amount to:

| | metric tons | | metric tons |
|---|---|---|---|
| Mineral matter | 19 300 | Lime | 600 |
| Potash | 9 800 | Phosphoric acid | 300 |
| Nitrogenous matter | 3 200 | | |

The whole of the above should be returned to the soil. The expense should not be great provided the " margines " are used in the same way as in Liguria and as advised by a number of writers (1).

The writer draws attention to the fact that COUPUT and GUILLAND have recommended the use of the " margines " as a fertiliser and advises their trial as insecticide, either in powder or wash form, against scale insects for instance.

446 – **A New Yeast Preparation for Use in the Estimation of Crystallizable Sugar by Inversion.** — PELLET, H. in *Procès-Verbaux de l'Association des Chimistes de Sucrerie et de Distillerie*, Vol. XXXIII, Bulletin No. 1-3, pp. 12-13. Paris, September 1915.

The above is an account of the different methods which have been proposed and applied for the estimation of crystallizable sugar by means of inversion by the aid of yeast or of its extracts with remarks on their advantages and drawbacks. A description is also given of a new method for the rapid preparation of a highly active yeast which is devoid of drawbacks and is capable of conserving its properties for a long period.

It hax been observed that on adding to the sugar solution 0.2 grms. of salicylate of soda per 3 grms. of baker's yeast, liquefaction of the yeast is practically instantaneous. This syrup of yeast or of invertase is capable of retaining its qualities for a long period. When required for use it is only necessary to dilute 30 grms. in 100 cc. in order to obtain a yeast liquor which also keeps for a long period. For purposes of inversion 10 cc. are added to 50 cc. of the specially prepared sugar solution to be inverted (neutral and free from lead). The mixture is heated in the waterbath for half an hour at 55° C., allowed to cool, made up to 100 cc. in volume and shaken. In the case of solutions of molasses addition is made of 1 grm of animal charcoal used for decolorising wines. The mixture is shaken, filtered and a small quantity of dry tripoli added, the whole shaken and filtered afresh, care being taken to protect the filter and glass from evaporation. Polarisation is effected with the 200 or preferably with the 400 tube and the crystallisable sugar estimated by means of the ordinary formula with the substitution, however, for the constant 144 (CLERGET) or 142.7 (German formula and method) of the constant 141.8 or 141.9 — ½ t.

The writer intends to return to the study of this constant and to indicate the exact method for its determination in each case.

The advantage of the yeast with addition of salicylate of soda is that it is easy to prepare and large quantities may be prepared at a time. The necessity for preparing more or less pure solutions of invertine is also avoided.

This decoction of invertine when added to the sugar solution is also very active, the operation being completed after half an hour's heating at 55° C., instead of 4 or 5 hours.

Further, there is no cold alcoholic fermentation and the liquid does not require heating before the addition of the yeast.

(1) See *B.* December 1915, No. 1259. (*Ed.*).

This method is capable of being applied to all the yeasts known. All that is required to be known is that the quantity of yeast added (3 grms. in 10 cc. per 50 cc. of sugar solution) is sufficient to invert an amount equal to 10 grms. of crystallizable sugar in half an hour at 55° C., as in the case of English yeast (a brewer's yeast of high fermenting capacity), in the case of KARCHER yeast (low fermentation) and in that of the Parisian bakers. The results obtained are very uniform and it is only necessary to exercise care in the preparation of the neutral solutions.

It is intended to treat of this latter process in a paper on the analysis of the products of the sugar industry by means of invertine.

447 – **Cold Extraction of Cream of Tartar from Grape Marcs by Cambiaggi's Method.** VECCHIA L., in *Giornale Vinicolo Italiano*. 42nd Year, No. 7, pp. 121-124. Casale Monferrato, February 13, 1916.

The CAMBIAGGI method for the extraction of cream of tartar from grape marcs is based upon cold treatment with commercial soda. The cream of tartar, which is almost insoluble in pure water, readily dissolves in water containing soda, forming a double tartrate of sodium and potassium. The soda solution is passed through the mass of grape marcs from below upwards and on emerging at the top, is reconducted in a similar manner through 4 other recipients. On leaving the 3rd recipient, the tartarous liquor is treated with hydrochloric acid and the acid potassium tartrate precipitated in the form of crystals. The mother liquors remaining are treated with lime and a new deposit obtained of calcium tartrate.

The marcs are mechanically treated in order to integrate and compress them in a manner which will allow of a uniform washing through every portion of each layer. The recipients are square in section, each side 2 ½ meters in length and communicate with each other by means of holes 40 cms. in diameter opening in the partitions. At their slow rate of progress the liquors take 1 day to exhaust the contents of a recipient.

The process is completed by the scientific utilisation of the residue. The grape stones are extracted and being rich in oil and devoid of tannin make an excellent cattle feed. The skins, separated from the stalks and cleaned by means of the " hydro-extractor ", dried and mixed with different substances, form a food already appreciated in the trade under the name of *œnofarine*. MARCHI'S experiments have shown that the small quantity of tartar remaining in the marcs is not only harmless to live-stock but even stimulates milk flow in dairy cows. One of the chief advantages of CAMBIAGGI'S method is that it gives a pure cream of tartar and not a crude one.

448 – **Colour Changes due to Micro-organisms in the Distillates of Plants and Flowers.** — GUYOT RENÉ, in *Journal de Pharmacie et de Chimie*, 10th Year, 7th Series, Vol. XIII, N° 2, pp. 37-46. Paris, January 1916.

The distillates of plants and flowers, particularly those of orange flower, are subject to deterioration correlated with the development of micro-organisms : they become turbid, viscous or thin ; their odour and flavour become attenuated ; their colour turns to yellow, green or violet.

The deterioration in orange flower water (which it is customary to keep in open recipients) has been attributed by BARNOUVIN to the presence of fungi, algae and bacteria.

The writer has recorded in a sample which he examined, the presence of a species of Mucorinae, *Hygrocrocis hydrolatorum* in the form of green flakes but has shown that the colouration is not due to this organism. Algae were absent. Whereas a drop of green orange flower water, when added to the healthy liquid, communicated to the latter the power of turning green, the former, when sterilised, no longer had this effect. The writer subsequently isolated a bacillus the description of which is as follows : form elongate, length 4 to 5 μ, breadth 0.5 μ, grouped in masses, liquefies gelatine, aerobic, non-chromogenic. A slight variation in the composition of the nutritive substratum is sufficient to cause the secretion of colouring matter on the part of the bacillus ; there are thus certain factors which favour colouration.

These factors are : 1) oxygen and oxydisers (reducing agents, on the other hand, attenuate or bleach the cultures) ; 2) light, especially violet and ultra-violet rays (distilled essences should therefore be kept in yellow and not in blue flasks as is too often done).

On the other hand, the formation of pigment is hindered by antiseptics and by certain metals (especially zinc); it is therefore advisable to make all consignments of orange flower water in zinc flasks. An acid medium favours Mucorinae ; a neutral or alkaline medium is favourable to bacteria.

The chromogenic principle appears to be a leucobase which turns red under the action of acids and green under that of alkalis. While the action of Mucorinae attenuates the perfume of the distillates of flowers, the deterioration of the colour often renders it more delicate.

This deterioration is not exclusive to orange flower water but spreads like an epidemic through the majority of the distillates (lettuce, rose, cinnamon, melissa). On the other hand, cherry laurel water offers a fairly strong resistance, even after inoculation ; the contained hydrocyanic acid acting as an anteseptic.

As a remedy, all the recipients through which the perfumes have to pass or in which they are to be kept should be washed by means of either steam under pressure or else of acidulated water.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS.

449 - **Pasteurization of Milk in Modern Practice.** — AYERS S. HENRY, in *United States Department of Agriculture, Bulletin* No. 342, 16 pp. Washington, D. C., Jan. 8, 1916.

The writer gives a rapid review of the principal results of recent experiments on the pasteurization of milk. According to the results of these experiments, the pasteurization of milk appears to be the best means discovered so far of destroying, or at least rendering harmless, such pathogenic organisms as : *Bacillus tuberculosis, B. typhi, B. diphtheriae,* the dysentery bacillus, and, according to the results of still later experiments, the causal agents of foot and mouth disease, scarlet fever and septic sore throat.

The sterilization of milk by electricity and by ultra-violet rays, though

very satisfactory for the destruction of bacteria, has not proved to be of value as a commercial process. (1).

During the last ten years there has been a rapid increase in the quantity of milk pasteurized, particularly in the larger cities. Milk investigations made in the United States, show that in 7 cities out of 9 with a population of more than 500,000 each, more than 50 per cent of the milk is pasteurized; out of 344 cities with over 10 000 inhabitants 51 have more than 50 per cent of their milk supply pasteurized, 116 have 11 to 50 per cent and 46 have 1 to 10 per cent pasteurized. In the remaining 131 cities the milk supply was not pasteurized. The general tendency is towards the pasteurization of all market milk.

At present, there are three processes of pasteurizing practised in the United States. The first is known as the flash, or continuous process, which consists in heating rapidly to the pasteurizing temperature, then cooling quickly. In this process the milk is heated from 30 seconds to 1 minute only, usually at a temperature of 160° F. or above. The second is the holder or holding process; this consists in heating the milk rapidly to temperatures of from 140° to 150° F. and holding it for approximately 30 minutes, after which it is rapidly cooled. The third process is known as pasteurizing in the bottle. The raw milk is put into bottles with water-tight seal caps, or devices which fit over the tops and necks of the bottles, protecting the ordinary paper caps from the water, then immersing them in hot water until heated to 145° F. and holding them at that temperature for 20 or 30 minutes. The cooling is accomplished by gradually lowering the temperature of the water until that of the milk reaches 50° F. The writer has also tried with good results another method of pasteurization, or rather, a modification of the holder process, which consists in bottling hot pasteurized milk at 145° F. in hot bottles which have been steamed for two minutes immediately before filling. The bottles are then capped with protective caps, and cooled by spraying or by forced cold air circulation. (2).

The process of pasteurization is frequently performed improperly. Records obtained in 1912 from 231 milk plants showed that 99 per cent of those which used the holder process pasteurized at the proper temperature. Among those which used the flash process only 57 per cent employed temperatures high enough to give satisfactory results. The pasteurization of milk by the holder process usually destroys about 99 per cent of the bacteria, but often the milk is re-infected during the cooling or filling of the bottles. In order to obtain a supply of sanitary milk in the cities a direct supervision of the milk plants is necessary, both as regards the cleanliness of the localities, the health of the cows, etc. In the control of pasteurization it is essential that the proper temperature be used and that the process be so performed that no re-infection takes place. This can best be accomplished by trained men who have authority to carry on such supervision, and by bacteriological control of the process. Bottles should be

(1) See *B.* Jan. 1912, N. 199. (*Ed.*)
(2) „ Oct. 1915, N. 1085. „

marked " Pasteurized " and show the date and the temperature at which the milk was treated.

The number and kind of bacteria that survive pasteurization depend entirely on the temperature to which the milk is heated. Experiments made by the writer have shown that with pasteurization at a temperature of 145° F., the acid group of bacteria remains more numerous than do the alkali and peptonizing groups ; and moreover, that certain classes of streptococci and part of the colon bacilli contained in the milk may also survive that temperature. (1). One of the reasons of the objection to pasteurization is that it destroys the acid-coagulating bacteria and leaves the peptonizing bacteria living, but this reason is based on the results of high temperature pasteurization and is not applicable to the holder process now generally practised in the United States.

Pasteurization by the holder process is in all cases superior to the flash process. From a bacteriological standpoint, pasteurization at 145° F. gives assurance, so far as we know, of a complete destruction of disease producing bacteria and at the same time leaves in the pasteurized milk the maximum percentage of the bacteria that cause milk to sour (lactic-acid bacteria) and only a small percentage of those that cause it to rot (peptonizers), the milk thus remains sweet for a longer period. From a chemical standpoint the advantage of low temperatures lies in the fact that milk pasteurized at 145° F., for 30 minutes, does not undergo any appreciable chemical change such as would affect its nutritive value or digestibility. It is now known to have little effect on the beneficial enzymes in milk and that the soluble phopshates of lime and magnesia do not become insoluble. (2). Pasteurization does not therefore injure the digestive or nutritive value of the milk even for feeding babies. According to the experiments made in this line by WELD, the slight difference was in favour of pasteurized milk. Finally, from an economic standpoint the cost of pasteurization is much smaller for the holder than for the flash process, the latter requiring 17 per cent more heat than the former.

From a series of tests in five establishments considered as representative of the average city milk plant, BOWEN found that the average cost of pasteurizing 1 gallon of milk is little more than three-tenths of a cent $ 0.0031 (3). This includes all the expenses necessary for heating and cooling the milk, coal, cooling water, labor, interest on invested capital and repairs.

450 – **Advantages of Using Milk of Low Bacterial Content in Studying the Phenomena of Lactic Fermentation.** — BURRI, R. and HOHL G., in *Schweizerisches Zentralblatt für Milchwirtschaft*, Year 5, No. 2, pp. 12-14 ; No 3, pp. 19-23. Brougg, January 20, 13 and 20, 1916.

The object of the writers is to increase our knowledge of the principles underlying the lactic fermentation test. Experiments are in progress at the Dairying and Bacteriological Institute of Berne-Liebefeld and re-

(1) See *B.* July 1913, No. 804 ; *B.* Dec. 1914, No. 1173 ; *B.* June 1915, No. 643. (*Ed.*)
(2) „ June 1913, No. 863. „
(3) „ March 1915, No. 319. „

sults will be published at intervals under the title of " Contributions to the knowledge of the scientific principles underlying the lactic fermentation test ". The present abstract is from the 1st portion of the series.

The researches of a large number of scientists, those of the present writer included, have shown that of the total number of bacteria contained in the milk immediately ofter drawing, $^1/_{10}$ th are derived from the interior of the udder. Opinion is divided as to the properties of these bacteria : by some they are considered to be harmless and without any effect whatever on the quality of the milk and its derivatives, while others hold a directly opposite opinion. The present writer obtained from 4 cows, by means of aseptic milking, milk samples with very low bacterial content : an average of 200-300 per 1 cc. The enumeration of the bacteria was carried out on cultures prepared by 3 different methods ; the numbers were in complete agreement notwithstanding the fact that the experiments extended over 3 different periods, each of several days duration. The species of bacteria were found to vary from cow to cow, even when the animals were side by side in the same stable. Further, the species were always constant for the same cow. Consequently, it may be safely concluded that these bacteria are derived from the interior of the udder and not from external sources.

The species found were : *Bacterium Güntheri* liquefactive in the milk of 2 cows ; white liquefying micrococci for the milk of the 3rd cow and liquefying micrococci and streptococci in the milk of the 4th. The fermentation test applied to these samples has shown that the liquefying *Bacterium Güntheri* is the chief factor exerting an unfavourable influence on the phenomena of lactic fermentation. This organism causes the formation of a curd whose degree of consistency is intermediate between that of casein and that of whey-curd.

It also produces a large amount of serum possessing a bitter flavour. In the milk sample containing almost exclusively liquefying white micrococci, the curd formed was somewhat cheese-like and in that containing streptococci in addition to the white micrococci, the consistency of the curd rather resembled that of whey-curd.

If these results are not sufficient in themselves to explain the whole of the unfavourable phenomena observed in the lactic fermentation test of milk obtained from these same cows, at any rate they show that the bacteria of the udder are not always inoffensive and may possibly have injurious effects on the quality of the milk and its derivatives. The fact that apparently healthy cows may harbour, in the udder, during a period of several weeks, practically pure cultures of suspicious bacteria (*Bacterium Güntheri* [liquefying] and streptococci) merits attention. In future, when enquiring into the defects of milk and in attempting to explain special cases arising in the utilisation of milk, it will be advisable to make use of aseptic samples of milk containing only bacteria from the udder.

451 – **Milk Quality as Determined by Modern Dairy Score Cards.** — Brew James D., in *New York Agricultural Experiment Station Bulletin*, No. 398, pp. 107-132. Geneva N. Y., March 1915.

Dairy score cards were originally designed to instruct the dairyman and to serve as a convenient record of sanitary conditions. Their use has led to a common belief that there is a relation between the score of the dairy and the quality of the milk produced by it. In order to prove whether this belief had any foundation, the writer has made a comparative study of the bacterial content of the milk and the scores of 34 commercial dairies made on three representative cards; the first card is the Official Score Card of the Official Dairy Instructors' Association, now adopted for New York State by the State Board of Health; the second is the one in use by the New York City Board of Health; and the third the one then in use by the Dairy Department of the Agricultural College at Cornell University.

In order to obtain accurate results, the writer himself undertook the investigation of the three systems, making himself personally familiar with each card and the manner of its application.

The samples of night milk and morning milk from each producer to be examined, were taken daily directly from the can as it was placed upon the milk station platform, taken at once to the laboratory and plated in lactose agar. The results of the comparison between the bacteria count of the milk and the dairy scores of 34 farms are given by the writer in several tables and a diagram.

These results prove that no correlation whatever exists between the number of bacteria contained in the milk and the scores expressed on the cards. Dairies with high scores produced milk with relatively high bacteria counts, while the best quality of milk from a bacterial point of view was produced in low-scoring barns. On the other hand, the scores obtained by the three cards when applied to the same conditions generally agreed in the case of the three best dairies, while for the other 31 dairies there were instances of wide variations, so much so that dairies which should have been scored as "good" and even "excellent" according to one system, would by another system be absolutely excluded. None of the 34 dairies under consideration scored below the exclusion point on either the Cornell or Official card, while 15 dairies scored below this point on the New York City card.

The writer believes that the reason for which no correlation exists between bacteria counts and the scores obtained by these three systems lies in the fact that a large number of the items included on the score card have little or no effect upon the number of bacteria present in the milk; while too little emphasis is placed upon the factors which actually do affect the milk. The results secured in this investigation show that present score cards cannot be satisfactorily used as a means of grading milk according to quality. There is little hope of designing a score card which will accomplish this purpose until all the factors which are thought to affect the quality of the milk in any way have been carefully studied; and the influence of each determined and accurately measured. In this way the

really important factors can be singled out and given the proper values on the score card, thus strongly influencing the improvement in quality and sanitary conditions of the milk supply.

452 – **The Detection of Added Water in Milk in India.** — LEATHER J. WALTER, in *Agricultural Research Institute, Pusa, Bulletin* No. 57, 7 pp. Calcutta, 1915.

The detection of added water in milk depends in Europe usually on the percentage of "solids-not-fat", which, according to English law, should not be less than 8.5 per cent. This method cannot, however, be applied in India where the milk sold in towns conists of cows' and buffaloes' milk mixed. The percentage of solids-not-fat in these is not identical, that of buffaloes' milk being generally greater because of the higher percentage of proteids it contains. The mean percentage of 136 samples of milk taken from 48 buffaloes and as many cows was 9.83, the probable error being ± 0.444. The buffalo milk vendor can thus add from 10 to 20 per cent of water without fear of detection.

The method adopted was that of detecting added water by the freezing point of the milk, which, according to the Queensland Government standard, should not be higher than — 0.55° C.

During the last two years, opportunities have been taken of ascertaining the freezing point of genuine milks at Government dairies in India, most of the samples being those of single cows or buffaloes. The amount of proteids contained in the milk affects the freezing point only in a minor degree, so that the freezing point of the two kinds of milk would be presumably about the same. The writer gives a table with the freezing points of 77 samples of cows' and buffaloes' milk tested in five different parts of India. The individual variations are considerable, but the samples have been mostly those of single animals, whereas the milk sold in towns is the mixed milk of a number, in which the variation is naturally less. The mean freezing point of all these 77 samples was — 0.542° C., and the probable error = ± 0.00907.

The effect on the freezing point of adding water to milk is substantially linear and may be expressed by the equation $W = ax$, where W = added water expressed in a percentage of the sample; $x$ = F.P of pure milk minus that of the sample; $a$) = a constant. The writer has estimated the value of $a$ in the equation from the freezing points of a series of portions of the same milk to which different (known) quantities of water had been added; the series of these tests yielded $a = -172$. As WINTER'S table gives $a = -176$, the writer holds the difference between the two to be immaterial and that — 174 may safely be taken as a good value. The equation then becomes $W = -174\ (-0.542 - t)$ where $t$ is the freezing point of the sample. Judging by the probable error which accompanies the mean value = 0.542° C., a freezing point of — 0.507° C., is possible once in a hundred times in the case of the milk of a *single* cow or buffalo; such a case would indicate 6.1 % added water. Such a case is not to be expected from mixed milks. Considering that the dairyman who waters his milk will not add so little as 5 per cent, it is quite certain that adulteration with

water can be detected by the chemist with certainty by the method based on the freezing point.

The writer, after some technical remarks on the manner of determining the freezing point, gives a table of the percentage of added water corresponding to the freezing point of the sample, ranging from — 0.542° C., to — 0.247° C.

453 - **The Chromogenic Micro-organisms of Cheese and their Presence in the Italian "Robbiola".** — DALLA TORRE GIULIO, in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLIX, No. 1, pp. 59-67. Modena, 1916.

The writer first gives a list of the principal chromogenic micro-organisms occurring in cheese, with notes on their action, and subsequently the results of a bacteriological analysis of a sample of "robbiola" cheese. The interior of the cheese was slightly spongy and the exterior covered by a thin yellow layer which enveloped the entire surface like a veil.

Two pieces were taken for analysis, one from the interior of the cheese in order to discover the micro-organism responsible for the sponginess and another from the outside in order to find the species producing the yellow colour.

In the first case, the action was due to a bacterium of the group *Aerogenes-coli* (the writer uses this nomenclature in preference to the usual name of the group *Coli-aerogenes* in order to indicate that this micro-organism is nearer to *B. aerogenes* than to *B. coli*). Of the 13 million bacteria contained in 1 grm. of cheese, 200,000 belonged to the above named group. The remainder was made up chiefly of *B. lactis acidi*.

The principal characters of the micro-organism producing the yellow colouring matter are as follows :

Micrococcus 0.8 to 1 μ in diameter.

Produces a yellow or yellowish green substance.

Necessarily aerobic.

Coagulates the milk and dissolves the coagulate, giving an acid reaction.

If cultivated several times in succession it loses its colouring properties and also its odour.

A comparison with the numerous bacteria producing a yellow substance described by various authors (often very similar to one another) shows no resemblance to any of these latter. Certain of its properties might place it at some little distance from *Micr. chromoflavus* (Huss), but it differs from this species in the following points : 1) by its behaviour towards milk and potatoes ; 2) by its odour ; 3) by its colour, which tends towards a yellowish green whereas that of *Micr. chromoflavus* is yellow chrome ; 4) by the colour produced at the surface of the cheese : yellow or yellowish grey, whereas *Micr. chromoflavus* gives a yellowish or reddish brown.

The micrococcus in question must therefore be regarded as a distinct species.

454 - **Fermented Milks** (1). — ROGERS L. A., in *United States Department of Agriculture Bulletin* No. 319, 31 pp. Washington, January 10, 1916.

The writer gives a brief resumé of our present knowledge of the subject, as it is treated in numerous both popular and scientific publications ; of these, 82 of the most interesting and important are mentioned in the bibliography.

The use of fermented milks as a therapeutic agent is based on the assumption that they are able to combat the so-called auto-intoxication caused by the undue accumulation in the body, of toxic substances emanating from the intestinal tract. The lactic acid bacteria introduced into the digestive canal with the fermented milk would there multiply and replace the injurious bacteria which, being in unfavourable conditions, would be driven out. A particular bacterium now universally known as *Bacillus bulgaricus* is supposed to be especially active in suppressing the putrefactive bacteria, because of its vigorous development and characteristic ability to form acid in exceptionally large amounts from sugars, particularly milk sugar. COHENDY, BELONOVSKY, and HERTER have found that *Bacillus bulgaricus* introduced into the intestine with curdled milk is readily established there, persisting for a considerable time after the subject has ceased to take fermented milk. RAHE concludes from his experiments that this bacillus persists in the intestine for only a few days after the ingestion of culture ceases, and in a recently published paper, he maintains that the difference between *B. bulgaricus* and certain acid-forming bacteria, which occur normally in the intestines, is so slight, that they can be distinguished only with difficulty, and he suggests that belief on the part of some investigators that *B. bulgaricus* becomes established in the intestines was caused by their inability to distinguish the two types. It is undoubtedly true that in many cases marked improvement has resulted from the ingestion of milk cultures made from *B. bulgaricus*, but it is by no means certain that the results which have been obtained by the use of milk cultures have been attributable to any peculiar virtue in the organism itself, or that the intestinal flora may have been radically changed by a fundamental change in the diet. In fact, DISTASO and SCHILLER, HERTER, KENDALL and RETTGER have found that the nature of the bacterial flora of the intestines could be promptly and distinctly changed by a radical change from a diet high in protein to one in which carbohydrates predominated, or vice versa. The conclusion seems obvious. The bacteria of the high-acid type, which are apparently normally present in the intestines, are stimulated by the unusual amount of milk sugar furnished by the milk-diet, and multiply to such an extent that the ordinary mixed flora is suppressed.

Although the fat is partially or entirely removed in fermented milks, their food value differs little from that of the fresh milk from which it is made. Any increased digestibility of the fermented milk is due, not so

(1) See *B.* July 1911 No. 2215 ; *B.* Feb. 1912 No. 402 ; *B.* June 1912 No. 963, *B.* Aug. 1912 No. 1190 ; *B.* March 1913 No. 301 ; *B.* Sept. 1913 No. 1086 ; *B.* Oct. 1915, No. 1086. (*Ed.*).

much to change in the chemical nature, as to the fact that the casein is furnished in a precipitated and finely divided condition. In none of the fermented milks is there any material cleavage of the casein resembling the digestion in the stomach. The fat is practically unchanged, and a part only of the sugar is converted into acid, alcohol, or carbon dioxide the last is believed to aid in the digestion of certain fermented milks.

In large cities several kinds of fermented milk are offered on the market such as buttermilk, sometimes koumiss and kefir, but more often yoghurt. In addition to these freshly prepared preparations, several tablets or capsules purporting to be pure and active cultures of the *Bacillus bulgaricus* are now offered for sale, to use for fermenting the milk. But these, even when prepared with care, lose their efficiency very quickly, *B. bulgaricus* being apparently particularly sensitive to dessication; it is therefore advisable that manufacturers should place the date of manufacture on each package and state the time within which the tablets should be used.

*Buttermilk* is the by-product resulting when milk or cream is churned for butter. If cream is churned sour, the acidity is sufficient to coagulate the casein which in the churning process is broken up into very fine particles. These settle very slowly, and if the buttermilk is agitated occasionally it will retain its milky appearance. When the cream is allowed to sour spontaneously, many bacteria other than the true lactic bacteria will take part in the acid formation, and in addition to lactic acid the buttermilk may contain in small quantities acetic, succinic, and formic acids, and sometimes traces of alcohol. To assist and control to some extent the acid fermentation of cream, certain prepared cultures, or starters, may be used which contain selected lactic-acid bacteria. Buttermilk, then, is the water of the milk holding the sugar, acids, ash and other soluble constituents in solution and the finely divided particles of precipitated casein in suspension.

Chemically, buttermilk differs but little from skim milk. Only a slight re-arrangement is necessary to bring about the plysical change in the casein to obtain a perfect substitute for buttermilk. At the present time a large part of the so-called " buttermilk " sold in cities, and also the product sold under the name of " ripened milk " is simply soured skimmed milk which has been churned or stirred in order to break up the curd. The writer gives directions for preparing this buttermilk both for market purposes and home use. The principal point is to secure a culture, or starter, which is merely milk containing the lactic acid bacteria free from other kinds. This may be obtained by allowing the milk to sour spontaneonsly, of by good artificial preparations. A more nearly uniform product is secured if the milk is pasteurized. The scorched taste which results from pasteurization at a high temperature is obscured by the acidity of the soured milk. After adding the starter, the temperature should be maintained between 21° and 24° C. (70° and 75° F.). As soon as a fine curd has been formed the milk should be cooled promptly to below 10° C. (50° F.) to prevent the contraction and toughening of the curd. A very refreshing and nutritious drink is obtained by adding sugar and lemon to buttermilk.

*Kefir* is made from the milk of sheep, goats or cows in the Caucasus mountains and neighbouring regions. It differs from most of the fermented milks in that it is made from a dried preparation and contains considerable quantities of alcohol and gas. Small, yellowish, convoluted masses are observed in kefir which are called seeds or "grains". The central part is made up of a mass of bacterial threads. In the outer layer yeast cells are found mingled with bacteria. These grains when dried in the sun are said to retain their vitality for several years. When they are added to the milk they swell and increase in size by forming new grains.

FREUDENREICH describes four organisms that he isolated from kefir grains. A yeast which he designates *Saccharomyces Kefir* ferments maltose and cane sugar, but not lactose. Two of the organisms were of the lactic-acid bacteria type, but differed from them in forming gas in lactose media. Another organism, to which he gives the name of *Bacillus caucasicus*, resembles *B. bulgaricus* but differs from it by forming gas from lactose and in being feebly motile. According to FREUDENREICH, the action of these four organisms in milk produces the typical kefir. NIKOLAIEWA considers only two organisms as essential to the production of kefir; *Bacterium caucasicum* (evidently identical with the *Bacillus caucasicus* of FREUDENREICH) and a kind of yeast fermenting lactose, dextrose, and cane sugar. The writer is of opinion that any combination of bacteria, or of bacteria and yeasts that will produce a lactic-acid and a mild alcoholic fermentation in milk, will make kefir, although to secure the most desirable flavour certain organisms are essential.

HAMMARSTEN shows in the following table the changes brought about in cow's milk by this fermentation:

*Chemical Analysis of Kefir.*

| Constituents | 2 days old per cent | 4 days old per cent | 6 days old per cent |
|---|---|---|---|
| Casein | 2.570 | 2.586 | 2.564 |
| Lactalbumin | .425 | .405 | .390 |
| Peptones | .071 | .089 | .120 |
| Lactose | 3.700 | 2.238 | 1.670 |
| Fat | 3.619 | 3.630 | 3.626 |
| Ash | .641 | .624 | .630 |
| Lactic acid | .665 | .832 | .900 |
| Alcohol | .230 | .810 | 1.100 |

Kefir grains cannot always be obtained, but a good imitation of kefir can be made by carrying on simultaneously in sealed bottles an alcoholic and a lactic fermentation. Better results can be obtained by inducing the alcoholic fermentation in buttermilk. Ordinary bread yeast may be

used for the alcoholic fermentation, but as this yeast does not ferment lactose it is necessary to add cane sugar to the milk. The writer gives detailed directions for preparing kefir.

The nomadic tribes of the plains of European Russia and Central and south-western Asia prepare a fermented drink called *koumiss* from mare's milk. Care is taken to produce an acid and an alcoholic fermentation, the necessary bacteria and yeast being thus soon established. The composition of koumiss is shown in the following analysis taken from RICHMOND'S Dairy Chemistry:

*Composition of Koumiss made from mare's milk.*

| Constituents | 1 day old per cent | 8 days old per cent | 22 days old per cent |
|---|---|---|---|
| Water | 91.43 | 92.12 | 92.07 |
| Alcohol | 2.67 | 2.93 | 2.98 |
| Lactic acid | .77 | 1.08 | 1.27 |
| Sugar | 1.63 | .50 | .23 |
| Casein | .77 | .85 | .83 |
| Albumin | .25 | .27 | .24 |
| Albumose | .98 | .76 | .77 |
| Fat | 1.16 | 1.12 | 1.30 |
| Ash | .35 | 0.35 | .35 |

It will be observed that this fermentation produces no changes that could be expected to increase appreciably the digestibility of the nitrogenous part of the milk, except the possible advantage of a finely divided curd. Kefir and koumiss are limpid, mildly acid and distinctly alcoholic; but yoghurt is a thick-curdled milk, decidedly acid and with very little or no alcohol. It is prepared from goat's, buffalo's or cow's milk in the countries bordering on the eastern end of the Mediterranean where it is known by different names. Unlike kefir there are no "seeds" through which the fermentation can be transmitted, but the essential organism is sometimes preserved by drying the fermented milk and reducing the dry material to powder. This constitutes the "podkwassa" or "maya". This bacterium essential for the preparation of yoghurt, was probably first observed by KERN (*Dispora caucasicum*) in 1881. Later, BEYERINCK studied and described it (*Bacterium caucasicum*), and also FREUNDREICH (*Bacillus caucasicus*). More recently, RIST and KOURHY (*Strepto-bacillus lebensis* and *Bacillus lebensis*). GRIGOROFF and COHENDY do not believe it to be limited to the oriental fermented milks, and recent work by HASTINGS, HEINEMANN and HEFFERAN, indicates that this bacterium is widely distributed, having been isolated from milk, soil, saliva, fœces, and various soured foods.

They are slender rods 2 μ to 6 or 8 μ in length, breadth usually about 1 μ; flagella and spores absent. Long chains frequently occur. Living cells are gram positive; dead cells are gram negative. This organism does not grow on ordinary media, but on whey, malt, and slowly on whey agar and certain specially prepared media. Most varieties grow equally well in the presence or absence of oxygen. The ability to ferment sugar probably varies in different varieties. This organism growing alone in milk, forms usually a rather slimy, tenacious curd, which does not ordinarily separate from the whey even on long standing, and cannot be broken up into the smooth creamy condition essential to a good buttermilk. Better results are obtained by adding a culture of an ordinary lactic-acid organism; but the best results will be obtained by making buttermilk in the ordinary way and churning it with an equal quantity of milk curdled with the yoghurt organism. Yoghurt may be made palatable by adding two parts of cold water, or better still cold aerated water, sugar and lemon juice or other fruit flavour, or chocolate syrup.

The writer concludes by giving directions for making yoghurt for commercial and for home use.

455 – **Biochemical Comparisons between Mature Beef and Immature Veal.** — Berg W. W. (Biological Chemist, Bureau of Animal Industry) in *Journal of Agricultural Research*, Vol. V, No 15, pp. 667-711. Washington D. C. January 10, 1916.

AGRICULTURAL PRODUCTS : PRESERVING, PACKING, TRANSPORT, TRADE

In both Europe and America immature veal is popularly regarded as difficult of digestion and unfit for human food.

These investigations were carried to compare immature veal (1-3 weeks old) with mature beef with regard to chemical composition, digestibility and physiological effetcs.

Determination of the nitrogen compounds showed no significant differences between the two kinds of meat. In artificial digestion experiments with acid pepsin and alkali trypsin, the veal digested as rapidly as the mature beef.

Cats were fed on a diet in which immature veal was the sole source of nitrogen. The young animals grew normally on the diet and the older ones became fat. A pair of cats after living two thirds of a year on the diet, produced a litter of healthy young kittens which continued on the veal diet with excellent growth.

These results indicate that immature veal is a very suitable meat when its deficiences in fat and possibly in small amounts of undetermined constituents are counter-balanced in the ordinary mixed diet.

456 – **Almond Growing and Trade in California.** — Pierce G. W., in *The Monthly Bulletin of State Commission of Horticulture*, Vol. IV, No. 11, pp. 494-499. Sacramento, Cal., November, 1915.

According to the most recent statistics, the annual almond crop of California, for the least 10 years, has averaged about 3 000 tons. During the planting seasons of the last five years, the acreage set to almonds has been so large that little, if any, of the almond variety has remained in the hands of the nursery man at the close of the several seasons.

In the opinion of the writer, this increase in the almond production will oblige the growers for the future to cooperate and form strong organisations, in order to be able to sell the crop at a sufficient remunerative price, in spite of foreign competition. The annual consumption of shelled almonds in the United States amounts to about 16 000 tons, most of which come from abroad. Of these imported almonds, 80 per cent are shelled, while, so far, the native product is sold in the shell, especially from December to February.

In order to put an end to this state of affairs, on the initiative of the " California Almond Growers Exchange ", a large almond-shelling establishment has been started at Sacramento ; the capacity of the plant is now 1 carload per day. The " California Almond Growers Exchange " of which the writer is President, began in 1910 with 11 local associations and 230 members, it now includes 18 associations and has nearly 900 members. About 80 per cent of the Californian crop is handled by the Exchange.

The writer is of opinion that within the next 5 years, the almond crop will be nearly 15 000 tons, and that the consumption could also be increased. Seeing the difficulties hitherto met with in the sale of the crop, the most important problem that presents itself to the almond grower in California is the marketing of the output. The positive results abready obtained by the above-mentioned institution, which sells the almonds at cost price, encourage the writer to hope that, in the future, this problem will be satisfactorily solved, and that the demand for almonds in America will be entirely supplied by the Californian product.

Brief reference is made to the unfavourable freight rates from California to the chief eastern markets, as compared with those paid for foreign products ; and to the insufficient import duty, in view of the lower cost of labour in the exporting countries.

457 - **Trade Standard for the Sale of Wine Lees and Tartar.** — *Giornale Vinicolo Italiano*, Year 42, No. 4, pp. 66-68. Casal Monferrato, January 23, 1916.

The price of wine lees and tartar is fixed, not only according to the net content in tartaric acid or in bitartrate of potash, but also on the basis of an average standard accepted by the trade. For lees, this standard is 28 per cent tartaric acid and 23 per cent bitartrate of potash ; for tartar, 68 per cent tartaric acid and 80 per cent bitartrate of potash.

458 - **The Sale of Eggs and Poultry in Massachusetts under Guarantee.** — *The American Agriculturist*, Vol. 96, N. 23, p. 14. New York, December 4, 1915.

The Massachusetts Poultry Society has adopted, for the use of its members, an official poultry products guarantee seal for both eggs and dressed poultry for the market.

The use of the seal is limited to those members of the society who will agree to the following rules :

1) That poultry and eggs shall be produced under clean and sanitary conditions.

2) The poultry and killing houses shall be open at all reasonable times to inspection by members of the executive committee of said association.

3) Eggs shall be gathered at least once a day, and when shipped or sold shall be not more than seven days old.

4) No unwholesome food shall be fed to the poultry.

5) Shells shall be clean in every case.

6) No eggs which have been in an incubator shall be shipped or sold under said seal.

7) Eggs shall weigh not less than 24 ounces to the dozen.

8) Dressed poultry shall be fresh killed.

9) No diseased poultry shall be killed and sold for table use.

10) The right to use said seal is forfeited whenever this agreement is in any respect violated, the member being held to reimburse said association for all payments and expenses made and incurred by it (after investigation and satisfactory proof) by reason and on account of inferior quality of poultry products shipped or sold under said seal.

# PLANT DISEASES

## DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

459 – **The Influence of Meteorological Factors on the Development of Plant Diseases.** — DOROGIN G. I., in *Materiali po Mikologhii i Fitopatologhii Rossii*, 1st Year, No. 2, pp. 3-9 (with 1 graph). Petrograd, 1915.

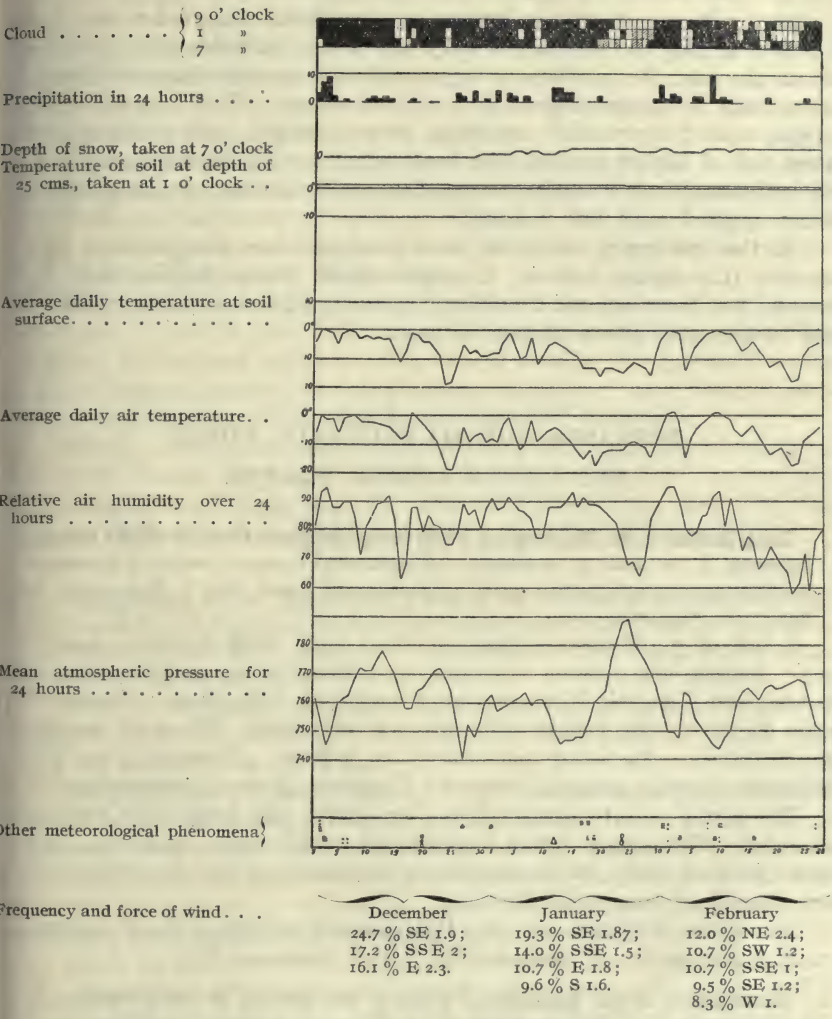
Although it has been long known that meteorological factors exercise a very definite influence upon the appearance and propagation of plant diseases, practically no continuous and methodic work has yet been done on this important problem. The Bureau of Mycology and Phytopathology of the Russian Ministry of Agriculture, aware of the necessity for a continuous series of observations on the development of fungoid diseases in relation to the progress of the weather, has set aside a chapter in its quarterly Bulletin for the publication of meteorological data, accompanied by graphs and diagrams. Observations are made of the following; air temperature, soil temperature (at surface and at depth of 16 to 25 cms.), relative humidity of atmosphere, humidity of soil at surface and at a depth of 10 to 25 cms., total precipitation, cloudiness, depth of snow, frequency and force of prevailing winds. Note is also taken of variable meteorological phenomena, such as extremely high and extremely low temperatures, frosts, hoar-frosts, hail etc. the action of which on plants is obvious.

In order to simplify reference to the Bulletin and its diagrams, instead of the usual 3 observations daily, in certain cases an average is taken of 24 hours or simply of 10 days. Although changes in atmospheric pressure have no perceptible influence on plants, a pressure curve is included in the diagram in order to complete the data.

The following rules have been established for the construction of the diagrams:

1) Values equivalent to 0.5 are indicated in the middle of the squares; values above 0.5 are taken as equal to 1 and lower values are not indicated at all.

*Winter* 1914-15.




2) When the thickness of snow is inferior to 0.5 decimeters it is indicated by a single line which practically coincides with zero.

3) The soil temperature at a depth of 25 cms. from 0.5° to 0° is regarded as equivalent to 0.5.

4) The quantity of rain from 0.5 to 0 mm. is indicated by a single line.

5) Cloudiness equal to 4 (sky totally covered) is shown in black ; cloudiness equal to 1, 2, 3 (sky $^1/_4$, $^1/_2$, $^3/_4$ covered) in grey. In the case of complete absence of cloud there remains a white square at the corresponding point of the diagram.

460 – **Yellowing of Sugar Beets in France during 1915** (1). — ARNAUD, G. in *Journa d'Agriculture pratique*, Vol. 29, No. 3, p. 50, Paris, February 10, 1916.

With reference to the yellowing of sugar-beets observed in the nortl of France during the summer of 1915, the writer excludes any specific ac tion on the part of a pathogenic agent and is of opinion that the disease i due entirely to meteorological and cultural causes. It is considered tha in light, sandy, dry soils containing little nitrogen, and similarly in th clayey soil of higher ground, the beets must have suffered from want c sufficient water, lack of cultivation and the smaller amount of nitrogenous fer tilisers applied, and late sowing.

On the specimens examined were found various fungoid and anima parasites (*Cercospora beticola, Uromyces Betæ, Phona tabifica* and *Aphi evonymi*) but they are not considered as being of any importance with re gard to the production of the disease.

## DISEASES DUE TO BACTERIA, FUNGI AND OTHER LOWER PLANTS.

GENERALITIES

461 – **Contribution to the Mycological Flora in the Neighbourhood of Kieff (Russia).** – JAVORSKI, A., in *Biuro po Mikologhii i Fitopatologhii Ucenago Comiteta Zemleustroistv Zemledielia, Materiali po Mikologhii i Fitopatologhii Rossii*, Year I, Part 2, pp. 10-3 Figs. 1-14. Petrograd, 1915.

A list of 72 Hymenoycetes collected near Kieff between 1910 an 1915. Among the species injurious to cultivated or useful plants are *Exobasidium Vaccinii* Woronine on *Vaccinium Vitis-Idaea* ; *Stereum hir sutum* Pers., on the trunks of hazel, oak and birch ; *Merulius lacryman* (Wulf) Schum ; *Daedalea quercina* (Linn,) Pers. ; *Trametes pini* Fries *Polyporus* (*Fomes*) *pinicola* Fries and *Polyporus* (*Fomes*) *fomentarius Frie*

The last is nearly always found on birch, less frequently on popl and alder. The fungus which develops on poplar differs from the charac teristic form on birch, by its fructifying organs being less consistent and a most devoid of concentric furrows.

Among the Polyporaceae are : *Poplyporus Schweinitzii* Fr., *P. squamosu* Fr., *P. sulfureus* Fr., *P. imberbis* Fr., and *P. betulinus* Fr.

462 – **Contribution to the Mycological Flora of the District of Tersk (Caucasus).** – VORONICHIN I., J. in *Biuro po Mikologhii i Fitopatologhii Ucenago Comiteta Zemleustroist i Zemledielia, Materiali po Mikologhii i Fitopatologhii Rossii*, Year I, Part III, pp. 7-1 Petrograd, 1915.

A list of 91 species of parasitic and saprophytic fungi collected durin the summer of 1914 in the district of Tersk. The following are new t science : *Cercosporella Lini* Woronich., on the leaves of *Linum nervosum* Waldst. and Rit. and *Rhodosticta onobrychidis* Woronich., on the livin leaves of *Onobrychis sativa* Lam.

(1) See also *B.* Jan. 1916 No. 117, and *B.* March, 1916 No. 357. (*Ed.*)

Eleven species are recorded for the first time in Russia: *Puccinia constricta* Lagerh., on the leaves of *Teucrium* sp.; *Phyllosticta faginea* Pech, on the leaves of beech; *Phyll. physaleos* Sacc., on the leaves of *Physalis alkekengi* L.; *Cytospora tiliae* Sacc., on the leaves of lime; *Stagonospora crepidis* Hollós, on the leaves of *Sonchus* sp.; *Septoria cruciatae* Rob. and Desm., on the leaves of *Galium cruciatum* Scop.; *S. melicae* Pass., on the leaves of *Melica uniflora* Retz.; *S. nepetae* El. A. E., on the leaves of *Nepeta cataria* L.; *S. poae trivialis* Cocc., on the leaves of *Poa nemoralis* L.; *Marsonia delastrei* Sacc. on the leaves of *Melandrium album* Gar., *Cercosporella veratri* Peck., on the leaves of *Veratrum album* L.; *Ramularia oreophila* Sacc., on the leaves of *Astrantia major* L., and *Cercospora cypripedii* Ell. et Dearn., on the leaves of *Epipactis latifolia* All.

Amongst the species most injurious both to cultivated and to wild plants are: *Septoria piricola* Desm. and *Gymnosporangium sabinae* Wint., on pear; *Microstoma juglandis* Sacc. which attacks the leaves of walnut; *Monilia cinerea* Bonord., which produces fruit-rot; and *Clasterosporium carpophilum* Aderh., which attacks the leaves of *Cerasus*.

Widely spread and common in the zone explored by the writer are also *Cercospora fraxini* Sacc. and *Septogloeum ulmi* Br. et Cav., on the foliage of ash and of elm; more rare are: *Oidium dubium* Jacz. and *Phyllosticta paginea* Peck., which is found on beech.

463 – **Contribution to the Mycological Flora of the District of Suchum, (Russia).** — Siemaszko V., in *Biuro po Mikologhii i Fitopatologhii Ucenago Comiteta Zemleustroistva i Zemledielia, Materiali po Mikologhii i Fitopatologhii Rossii*, Year I, Part 3, pp. 23-41, Figs. 3-19. Petrograd, 1915.

A list of 217 species of fungi collected during the autumn of 1913 and during 1914 in the district of Suchum and other parts of Transcaucasia along the coasts of the Black Sea.

The following are new to science: 1) *Mycosphaerella phaseolorum* Siemaszko, a Pyrenomycete which, occurring on the leaves of *Glycine soja*, *Phaseolus mungo*, and *Vigna rubia*, forms whitish spots with a darker border; this fungus is very similar to *Mycosphaerella phaseolicola* (Desm.) Sacc. from which, however, it differs in shape and in the dimensions of the spores; 2) *Sphaerulina suchumica* Siemaszko, another Pyrenomycete, which was found on the leaves of *Gossypium herbaceum* and *Hibiscus exulentus*; 3) *Exobasiduum citri* Siemaszko, which attacks the unripe fruit of *Citrus* sp. on which it develops as a whitish, hard, sclerotic crust; mandarin is the favourite host-plant; this disease resembles very closely in its external characters the "incalcinatura" of the lemon of Savastano and "white rust of lemons" described by Briosi and Farneti, which, according to those writers, is due to *Ovularia citri* Br. et Farneti, together with several other fungi; 4) *Cercosporella epimedii* Siemaszko, which forms on the leaves of *Epimedium pinnatum* var. *colchicum*, large round spots of a dirty white with dark-grey border; this fungus was found in a forest on the banks of the river Kelossuri near Suchum; 5) *Ramularia trachystemonis* Siemaszko which forms a whitish veil on the leaves of *Trachystemon orien-*

*talis* ; 6) *Cercospora guizotiae* Siemaszko, which causes grey spots to appear on the leaves of *Guizotia oleifera*.

464 - **New Record of *Puccinia Galanthi*, in Austria.** — KEISSLER K. in *Oesterreichische Botanische Zeitschrift*, Year 65, No. 7-8, pp. 236-238. Vienna, 1915.

In 1833 a new fungus was reported by UNGER as occurring on the leaves of *Galanthus nivalis* taken from the meadows near Stockerau, Lower Austria. He named this fungus *Puccinia Galanthi*, but no accurate description was made. The parasite was lost sight of for a long time, until VON BECK found it in his garden at Währing, near Vienna. The fungus has been described by WINTER.

At about the same time, the presence of *P. Galanthi* was reported from Hungary by LINHARD.

Fifteen years later, in 1897, BUBAK reported a new habitat of the fungus in Moravia and described the parasite.

Up to 1897, therefore, this fungus had been recorded in four different habitats ; since that date there is no further record of its occurrence.

During an excursion made in May 1915, in the valley of the Danube, the writer found no trace whatever of the fungus. A week later, in visiting the same places, he found it in such quantities as to be able to make a large collection. It was also noticed to occur on very young plants.

The distribution of the fungus shows clearly the existence of a centre of infection where the plants are very strongly attacked, while towards the periphery of the infected zone the fungus becomes gradually rarer.

Research on the method of reproduction of *P. Galanthi* has shown that the spores occur on the under surface of the leaves.

As it forms no spots on the leaves it is extremely difficult to identify. Research on this point is being continued. From a systematic point of view it is noted that *P. Galanthi* closely resembles *P. Schroeteri* and that it attacks *Narcissus poëticus*.

Besides *P. Galanthi* another species of Uredineae is reported, *Caeoma Galanthi*, Schröt, which differs from the first by the paler colour of the spores. The teleutospores develop on *Salix fragilis*. This species has already been reported from several places.

Both these rusts have been found repeatedly on the same leaf, but no genetic relation is thought to exist between them.

RESISTANT PLANTS.

465 - **Relation between the Concentration of Hydrogen Ions and the Natural Immunity of Plants.** — WAGNER J. in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 44, No. 24-25, pp. 708-719. Jena, January 12, 1916.

The writer had previously noticed that the injection of phytopathogenic bacteria into certain plants, produced in their tissues, in addition to bactericidal substances, a variation in the concentration of the hydrogen ions.

Plants of *Sinapis alba*, *Brassica oleifera*, *Sempervivum Hausmanni*, and tubers of potatoes were inoculated with pure cultures of *Bacillus vulgatus* or of *Bac. phytophthorus*, or of *Pseudomonas campestris*. *Brassica* and *Sempervivum* were kept in an unheated glasshouse, *Solanum* and *Sinapis*

in the open. The potato tubers were kept during the experiment in a receptacle at a temperature varying between 22° and 30° C. Before injecting the bacteria, the portion of the plant treated was washed in a 3% solution of hydrogen peroxide and well dried with alcohol. Some time after the injection, a sample of sap was taken from the plant and tested for its bactericidal power and for its acidity or the concentration of the hydrogen ions. The variations in the concentration of the ions are regarded as part of the reaction against the injection of the phytopathogenic bacteria. Immediately after the injection the acidity of the sap decreases, but increases again immediately the first symptoms of the disease appear. If after infection the plant is able to resist the disease, the concentration of the hydrogen ions decreases and after a certain time becomes the same as in healthy plants. When the plant is unable to withstand attack, the concentration of the hydrogen ions augments greatly, subsequently falling below that of normal plants.

466 – **Sugar-canes Resistant to Root-rot and Maize Resistant to Insect Attacks, in Cuba.** — See No. 396 of this *Bulletin*.

467 – **Angular Leaf-Spot of Cucumbers in America caused by *Bacterium lachrymans*.** — SMITH ERWIN F. and BRYAN MARY KATHERINE in *Journal of Agricultural Research*, Vol. V. No. 11, pp. 465-475, Pl. XLIII-XLIX. Washington, D. C. 1915.

DISEASES OF VARIOUS CROPS

The angular leaf spot of cucumbers (*Cucumis sativus*) has been known in the field for many years, but so far no organism has been named as its cause, though it has generally been conceded to be of bacterial origin. O. F. BURGER, of Florida and G. B. TRAVERSO, in Italy (1), are responsible for most of the literature on the subject.

From the examination of material from a number of different sources, the writers have identified and described the organism responsible for the disease as *Bacterium lachrymans*.

The disease is characterised by angular brown spots which tear or drop out when dry, giving to the leaves a ragged appearance. Young stems and petioles may become soft-rotted or cracked open. In the early stages a bacterial exudate collects in drops on the lower surface during the night and dries whitish. During the early stages bacteria have been isolated from this liquid. These are white in colour, very motile, 0.8 μ in width and 1 to 2 μ long, grouped in couples and more rarely united in chains consisting of as many as 12 individuals.

The optimum growth temperature lies between 25° and 27° C., exposure to direct sunlight is fatal in 95 per cent cases and exposure for a few minutes only to low temperatures kills 90 per cent. Inoculation experiments with *Bacterium lachrymans* on healthy plants gave absolutely positive results.

The organism penetrates into the leaves through the stomata and taking up its position in the cavities beneath, spreads into the surrounding tissues, giving rise to the pathological symptoms already noticed.

(1) See *B.* June 1915, No. 656. (*Ed.*)

This disease has already been recorded in the following parts of America: in Michigan at Big Rapids, Muskegon, Grand Haven, Holland, Grand Rapids, Hudsonville; in Indiana at Plymouth, Monterey, Tyner and Donaldson; in Wisconsin at Racine, Portage, Ripon, Princeton and Milwaukee; in New York State at Constable, Malone, North Lawrence and Long Island; in Connecticut, in the district of Columbia, in Maryland and other Southern States. In Canada the same disease is known in the provinces of Ontario and Quebec.

Considering the results obtained in the laboratory with copper sulphate, it would seem that Bordeaux mixture properly applied is the best remedy for this disease.

468 - **A Celery Fungus *(Septoria Petroselini* var. *Apii)* New to Yorkshire** (1) — ROE T. B. in *The Naturalist*, No. 708, pp. 14-15. London, 1916.

*Septoria Petroselini* Desm. var. *Apii* Br. and Cav., injurious to celery, has just been recorded in the Scarborough district. This fungus is new to Yorkshire. Although previously known on the Continent and in N. America, the first authentic record of its appearance in England was in 1906, in South Devon. Since then it has caused much damage to celery both in England and Ireland.

In 1914, three quarters of a crop of 30,000 head of celery were lost through this disease alone. In 1915, though it did not make its appearance with the same severity, still the damage caused was considerable.

The disease is usually observed about the end of July or beginning of August after it has become well established.

As it has been proved that the " seed " has been known to contain fruits of the fungus, washings from which have been made by experiment to infect healthy plants, it would be advisable for growers to watch their *young* plants, and at the first sign of the disease to spray them with dilute Bordeaux mixture or potassium sulphide solution. As a precautionary measure, microscopical examination of samples of " seed " might be made, and if the fungus be detected thereon, washings in a fungicide might be tried, although it is possible that this would be little more than a palliative. Growers should promptly burn all diseased foliage. The practice of throwing diseased plants on to a rubbish heap is a great mistake as there is no doubt that the fungus can live through the winter and attack fresh plants the following year.

It is said that with many visitations like that of 1915, celery growing would become impracticable.

This disease should not be confounded with that caused by *Phyllosticta apii* Halsted, from which it is distinguished by the shape of the spores.

469 - ***Peronospora parasitica* and *Septoria Petroselini* var. *Apii* Injurious to Broccoli and Celery in Latium.** — SEBASTIANELLI A. in *La Nuova Agricoltura del Lazio*, Year IV, No. 74, p. 20. Rome, Feb. 1, 1916.

*Peronospora parasitica* is very prevalent in the market gardens of Velletri, Cori, Cisterna etc. on the leaves of brocoli. Recently, the spread of

(1) See *B.* Oct. 1914, No. 957. (*Ed.*)

the disease has become so serious that in some gardens but very few plants escaped damage. Celery was very severely attacked by *Septoria Petroselini* var. *Apii*.

470 - **Diseases and Pests of the Cranberry, *Oxycoccus (Vaccinium) macrocarpus*, in the United States** — FRANKLIN H. J. in *Massachusetts Agricultural Experiment Station, Bulletin* 160, Report of Cranberry Substation for 1914, pp. 91-117. Amherst, Mass., 1915.

*Fungous diseases.* — These studies were carried on in cooperation with the Bureau of Plant Industry of the United States Department of Agriculture.

The " ring worm " trouble (commonly so-called because it was formerly supposed to be the result of the work of some insect) was given some study. The vines die in a small patch at first and, the centre recovering, the affected area gradually becomes circular. These patches persist for years, the vines on the outer side of the rim dying every season, while recovery takes place on its inner side, the circle thus growing larger yearly unless stopped by a ditch or some other obstruction. One grower has obtained good results by making 2 or 3 treatments in successive years with Bordeaux mixture.

The disease known as " false-blossom " hitherto only known in Wisconsin has been recorded for the first time in Massachusetts. The disease is evidently of a very serious character and very infections.

The disease called " Blossom-end rot " is the chief cause of decay among " Late Howe " berries in storage. Its exact place in botanical classification is not yet determined.

As regards methods of treatment of fungoid diseases experiments have been continued with Bordeaux mixture on plots manured and unmanured. Records were kept of the crop yield obtained and its keeping qualities. The results were contradictory but, generally speaking, the treated plots gave lower crops and smaller fruit than the control plots ; spraying is therefore not to be recommended except in the case of plantations which are exceptionally severely attacked.

Treatment with Bordeaux mixture (Dr SHEAR'S formula) at the flowering period caused a diminution in the crop yield of more than 13 per cent.

Attempts at treatment were also made by dissolving copper sulphate in the irrigation water (1 part in 50 000 parts of water). The yield was not affected.

The lack of success with the above treatments is probably due to their bad effect on the roots.

Sanding of the plantations did not appreciably increase the yield, but it encouraged fungoid diseases and impaired the keeping qualities of the fruit.

*Insect pests* (1). — The army worm (*Heliophila unipuncta* Haworth)

(1) See also *B.* Dec. 1915, No. 1361. (*Ed.*)

attacked plantations of *Vaccinium* at Cape Cod, but except in a few cases the damage caused was not serious.

The " gipsy moth " (*Porthetria dispar*) caused considerable damage to *Vaccinium* in several localities and is becoming more of a menace every year.

The " cranberry weevil " (*Anthonomus suturalis* Lec.) which occasionally harms a bog by working within the blossom buds and eating out their hearts, did much damage on some bogs in Plymouth in 1913 and also caused some loss in the same locality this year.

Arsenical sprays (" Bordo " lead with Paris green) applied before the flowering period did good service.

The " spanworm " (*Epelis truncataria* var. *faxonii* Minot) did serious damage in a bog at Wareham. Several of the pupae were found to be parasitised by an Ichneumon new to science (*Campoplex variabilis*). Live pupae were found after the bog had been submerged for five months.

The dying of the tips which has often been noticed at intervals is due to attacks by the larvae of the " cranberry tip worm " (*Cecidomyia oxyoccana* Johnson).

Both eggs and larvae were found on the tips (as many as 5 on a single tip); the larvae form their cocoons in the soil. Flowed bogs, in case they had not been resanded before the 1st of May were, as a rule, much more seriously injured than were strictly dry bogs (without winter flowage). Flowed bogs which had been resanded the previous autumn or in the spring before the 1st of May were, as a rule, much less seriously injured than those not so resanded. No bog showed great tip worm injury after a period of severe frosts. The " Late Howe " variety, as a rule, showed distinctly more injury than did the " Early Black ".

For the control of the " flowed bog fireworm " (*Rhopobota vacciniana* Pack), in addition to the remedies already cited, the writer recommends treatment with sweetened arsenical sprays.

Nearly a dozen natural enemies of the " cranberry fruit-worm " have been identified and bred, only 3 are abundant enough to be of importance : a Braconid (*Phanerotoma tibialis* Hald), a species of Ichneumon (*Pristomerdia agilis* [Cress] Ashm) ; a Chalcidid (*Trichogramma minuta* Riley).

471 - ***Puccinia Iridis* on Cultivated *Iris*, New to Yorkshire.** — Roe T. B. in *The Naturalist*, No. 708, p. 27. London, 1916.

*Puccinia Iridis* Wallr. is recorded for the first time on cultivated *Iris* in some gardens at Scarborough.

472 - **Apple Tree Mildew, *Podosphaera leucotricha* Salm., New to Yorkshire.** — Roe T. B. in *The Naturalist*, No. 708, p. 27, London, Jan, 1916.

The above is a first record for Yorkshire of *Podosphaera leucotricha* Salm. The apples attacked were from trees at Ebberston, near Scarborough and had suffered severely, being small in size and studded with the perithecia of the fungus. The specimens found were in the ascigerous or perfect stage which is apparently rare in England, the oidium or conidial stage being that usually met with.

473 - **"Sooty Blotch" of the Pear (*Leptothyrium carpophilum*) in England.** — SALMON E. S. and WORMALD H. in *The Gardener's Chronicle*, Vol. CIX, No. 1518, pp. 58-59, Figs. 25-28. London, Jan. 28, 1916.

The writers have met with two instances where pears of the "Catillac" variety — in one case grown in a garden at Reigate, Surrey and in the other case at Wye, Kent — become severely attacked by the "Sooty Blotch". The disease is probably due to *Leptothyrium carpophilum*.

The writer describes the points of difference between this latter organism and *Lept. Pomi* which causes the "sooty blotch of the apple".

474 - ***Sclerotina Linhartiana* on Quince, New to Bulgaria.** — MAIDENOW V. in *Zemledielie Spisanie no Belgarskoto Zemledielsko Druxestvo*, Year XX, Vol. 7, pp. 190-191. Sofia, 1915.

The disease of quince caused by *Sclerotinia Linhartiana* Prill. et Del. the conidial form of which is known by the name of *Monilia Linhartiana* Sacc., has been reported for the first time in Bulgaria at Borisovgrad, Sadoro (Plodvisko), Ternovo, Riustendit, and Giumurgina. In damp weather the pest spreads with great rapidity and in a few days as high a proportion as $^1/_{20}$ of the foliage may be affected. The fungus attacks the leaf near the petiole, spreads along the mid-rib and following the lateral veins, gradually covers the entire leaf.

Irregular spots of a dirty-white colour appear on the surface of the leaf, these gradually coalesce and become covered with a whitish veil of the hyphae and conidia of *Monilia*. These conidia, through insect agency gain access to the flowers and germinate, developing a branching mycelium which eventually reaches the ovary. The processes of fertilization, swelling and formation of the fruit are thus very materially affected and when winter comes all the infected parts fall to the ground.

In the spring, the apothecæ of *Sclerotinia* develop on the fallen fruit, and the ascospores which form attack in their turn the young growing leaves, thus spreading the disease over a still wider area.

The following methods of control are advised :

1) Cutting off all infected parts and destroying by burning ;

2) Spraying with Bordeaux mixture before the leaves begin to bud, as a preventive measure ;

3) Dusting the diseased plants with calcium sulphate.

475 - **A Honeycomb Heart-Rot of Oaks Caused by *Stereum subpileatum*.** — LONG WILLIAM H. in *Journal of Agricultural Research*, Vol. V, No. 10, pp. 421-428, Pl. XLI. Washington, D. C., 1915.

During investigations made in 1912, 1913 and 1914 on the pathological condition of the oak (*Quercus* spp.) in the National Forests of Arkansas and other sections of the United States, the writer found a large percentage of the trees, especially in some regions of Arkansas, attacked by various species of heart rotting fungi. Among these were *Polyporus pilotae*, *P. berkeleyi*, *P. frondosus* and *P. dryophilus*. In addition to the foregoing a new type of rot was found caused by *Stereum subpileatum*.

In the final stage of this rot the diseased wood resembles a piece of honeycomb, hence the name.

So far, this rot has been observed, in Arkansas, on *Quercus alba, Q. lyrata, Q. palustris Q. phellos, Q. rubra, Q. texana, Q. velutina ;* in Florida, on *Q. virginiana, Quercus* sp. and *Liquid-ambar styraciflua ;* in Kentucky, on *Querus* sp. (?) ; in Louisiana, on *Q. lyrata ;* in Mississippi, on *Q. phellos* ; in Missouri, on *Q. palustris* (?) ; in Virginia, on *Q. alba, Q. coccinea, Q. Prinus* and *Q. velutinea ;* in Mexico on *Quercus* (?).

The only practicable method of control which can be applied to the forest as a whole is to prevent, so far as possible, the infection of the trees. This can be done 1) by eliminating all forest fires, since they produce wounds on the butts of trees through which the fungus enters ; 2) by preventing the formation of the fruiting bodies (sporophores) of the fungus which produce the spores. This can be done by destroying all diseased timber which contains this rot.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

GENERALITIES

476 - **The Psyllidae of the Clevelands (England).** — HARRISON. J. W. H. in *The Naturalist*, No. 707, pp. 400-401. London, 1915.

The following is a list of some of the Psyllids found on useful plants over a limited section of the Cleveland area :

*Aphalara calthae* Linn. on larch and spruce ; *Psyllopsis fraxinicola* Först,, *P. fraxini* Linn and *Psylla pyricola* on ash ; *Psylla salicicola* Först and *P. ambigua* Först. on sallow ; *Psylla hartigii* Flor., on birch ; *P. pineti* Flor., on conifers ; *F. melanoneura* Först on oaks and conifers ; *P. costalis* Flor., on blackthorn, hawthorn, mountain ash, oak, etc.; *P. peregrina* Först., on hawthorn ; *P. mali* Schm., on crab apple ; *P. alni* Linn. at *P. försteri* Flor., on alder ; *Trioza urticae* Linn. on elm, blackthorn etc., *T. albiventris* Först. on sallow and silver fir.

MEANS OF PREVENTION AND CONTROL

477 - **The Asparagus Beetle Egg Parasite.** — Ross, W. A. in *The Agricultural Gazette of Canada*, Vol. 2, No. 11 pp 1055-1056, 3 Figs. Ottawa, 1915.

Early in the month of June, 1915, large numbers of a minute, dark blue-green, four-winged chalcid fly were found destroying the eggs of the Asparagus beetle, *Crioceris asparagi* L. at Vineland Station, Ontario.

The fermale, by means of a sharp ovipositor, pierces the egg of the Asparagus beetle and deposits within it her own eggs (three to nine in number). In due course the beetle egg, its viability unaffected, hatches and the grub grows to maturity.

The larvae of *Crioceris* resist for some time, and reach the pupal stage but they are then killed. The adult chalcid is a voracious feeder on the eggs, accounting for as many as 90 per cent. At the Vineland Station Experimental Farm the work of the egg parasite was so effective that it was found possible to dispense with the customary spraying of the asparagus plants.

INSECTS INJURIOUS TO VARIOUS CROPS

478 - **Appearance of Swarms of *Contarinia tritici* in South Russia during 1914.** — BORODINE D. N. in *Khosiaistwo*, No. 43-44, pp. 1022-1029. Kieff, 1915.

Russian entomology makes but rare mention of *Contarinia tritici* Kirby. Amongst the few who have treated the subject is quoted N. M. KA-

LUGHINE, who wrote, in 1913, that in Russia not much harm was done to wheat by this member of the Diptera. Two years later, however, the insect appeared in swarms in the two South Russian provinces of Poltava and Kherson, especially in the former. Observations made by the writer himself, and communications received from correspondents of the Entomological Department of the provincial Zemstwo of Poltava have shown that the adult insects made their appearance between May 9 and 20 (old style). The writer, however, believes that period to have been a good deal longer.

Oviposition took place over the whole of the time and about June 12 large numbers of the larvae were hatched and continued to appear up till harvest time. Their number then greatly diminished, especially after the rain. The descent of the larvae to the soil to pupate occurred towards June 20, when rain began to fall and the number of larvae on the ears rapidly diminished; finally they quite disappeared. After the disappearance of the larvae from the wheat harvested in the fields of the Experimental Agricultural Station of Poltava, a careful search was made for them on the soil beneath the sheaves, but with no result. A number of larvae of *Contarinia* were put into small glass tubes during the months of June and July 1914. Although the conditions were most unfavourable owing to the sand of the boxes in which the tubes were placed not having been watered since the spring of 1913, and watering only being carried out in the middle of May, between June 2 and 8 a number of parasites were bred from the larvae and identified by N. W. KOURDIOUMOW as *Geniocerus brevicornis* Nees (8 specimens), *G. clavicornis* Thomas (3 specimens), *Geniocerus* sp. (1 specimen).

In order to ascertain the amount of damage caused by *Cont. tritici* the number of larvae and cocoons on each ear were counted, and also the number of injured grains. The percentage of the injured grains was calculated on the total number of grains contained in a 100 ears of corn. Usually the proportion of ears attacked was 80-90 per cent. The proportion of damaged grains 10.06 per cent.

In the following table are given the results of 7 examinations:

| Species of cereal attacked | Date of sowing | Date of examination | Number of ears | Total number of grains | Number of injured grains | Percentage |
|---|---|---|---|---|---|---|
| 1. Spring wheat | — | June 11–13 | 100 | 2 106 | 212 | 10.016 |
| 2. » » | August 5 | » 27 | 100 | 2 736 | 267 | 9.75 |
| 3. » » | » 13 | » 27 | 100 | 2 298 | 144 | 6.26 |
| 4. » » | » 25 | » 28 | 100 | 2 354 | 26 | 1.09 |
| 5. » » | September 5 | » 30 | 100 | 2 624 | 19 | 0,72 |
| 6. Spring rye . | — | » 16 | 100 | 3 896 | 175 | 4.49 |
| 3. Spring wheat | — | » 20 | 93 | 1 386 | 212 | 15.2 |

The amount of damage caused is correlated with the time of sowing for, as may be seen by examinations 2, 3, 4, and 6, the early sowings were most severely attacked, a fact which is probably connected with the swarming period of *Contarinia*. Comparing the damage caused to wheat by other insects the most serious is that caused by *Contarinia*, and the attention of entomologists is drawn to the fact that the insect in question caused in North America damages assessed at some millions of dollars.

479 – **The Influence of Rainfall and the Non-Burning of Trash on the Abundance of *Diatraea saccharalis*, Injurious to the Sugar Cane** (1). — WOLCOTT GEORGE N. in *Govt. of Porto Rico, Board of Commissioners of Agriculture, Insular Experiment Station, Rio Piedras, P. R., Circular No. 7*, pp. 1-6, 1 diagram. San-Juan, Porto Rico, 1915.

The most important insect injurious to sugar cane in the Western Hemisphere is the smaller stalk-borer, *Diatraea saccharalis* Fabr. which occurs in abundance in the southern limited States, Mexico, Cuba, Jamaica, Santo Domingo, Porto Rico, St Kitts, Barbados, Trinidad, Demerara and Argentina, besides other islands and countries of lesser importance in sugar production.

The extent of the damage caused by this insect varies in different localities and between very wide limits. As a result of numerous voyages and researches, the writer has been able to fix the following points :

1) There is an inverse relationship between the total annual rainfall and the abundance of *Diatraea*.

2) The burning of trash on the field after the cane is harvested kills large numbers of *Trichogramma minutum* Riley, the most effective enemy of *Diatraea*, and consequently favours the development of this latter. This is found to be true for all localities and the burning of trash is therefore to be discouraged.

It is particularly important to draw the attention of planters to this fact, as one of the most common methods used for the control of insect pests is precisely that of burning the trash on the fields.

*Diatraea* is not abundant in Jamaica, but there is a noticeable difference between the north and south sides. On the south side, *Diatraea* infests 15 to 30 per cent of the stalks. The difference is due to the amount of rainfall, the total precipitation being much higher in the north where the insects are scarcer.

In Barbados the scarcity of rain favours the development of the pest, nor does the presence of *Trichogramma* act as a sufficient check.

In Cuba, in the sugarcane districts of Havana, Matanzas and Santa Clara, where the annual rainfall averages from over 50 inches to nearly 90 inches, *Diatraea* attacks about 10 per cent of the canes. In Camagüey and Oriente provinces where the annual rainfall is from 30 to 50 inches, the infestation by the borer is 40 per cent.

(1) See also *B.* Oct. 1915, No. 1106.

*Ed.*).

The following table gives data relating to Porto-Rico :

| Locality | Inches of rainfall 1914 | Percentage of infestation 1914-15 | | |
|---|---|---|---|---|
| | | Average of all fields | Fields where trash was burned | Fields where trash was not burned |
| Coloso | 101 | 6 (8) | . . . . . | 6 (8) |
| Añasco | 95 | 5 (6) | . . . . . | 5 (6) |
| Fajardo | *76 | 11 (15) | 13 (6) | 9 (9) |
| Manati-Morovis | 72 | 6 (9) | 10 (5) | 4 (7) |
| Canóvanas | 70 | 11 (9) | . . . . . | 11 (4) |
| Toa Baja | 70 | 15 (8) | 19 (4) | 10 (4) |
| Rio Piedras | 66 | 17 (7) | . . . . . | 17 (7) |
| Vega Baja | 66 | 39 (9) | 44 (5) | 26 (4) |
| Caguas | 58 | 6 (5) | . . . . . | 6 (5) |
| Jabucoa | 58 | 37 (5) | 60 (2) | 22 (3) |
| Arecibo | 55 | 26 (16) | 69 (1) | 23 (15) |
| Juana Diaz | 60 | 32 (9) | 34 (8) | 18 (1) |
| Guayama-Josefa | 45 | 47 (4) | 47 (4) | . . . . . |
| Aguirre | 34 | 45 (7) | 50 (5) | 31 (2) |
| Potala | 27 | 37 (9) | 44 (6) | 24 (3) |
| Ponce | 25 | 48 (8) | 48 (8) | . . . . . |
| Destino-Salinas | 23 | 64 (5) | 77 (3) | 44 (2) |
| Guayanilla | 24 | 76 (5) | 76 (5) | . . . . . |
| Santa Isabel | 22 | 72 (4) | 78 (3) | 46 (1) |
| Guánica | 21 | 66 (28) | 68 (24) | 31 (4) |

* Average of rainfall of *haciendas*, not of the town. Figures in brackets after percentages indicate numbers of fields examined.

The eggs of *Diatraea* are deposited on the leaves of the cane, and when the young larvae hatch a considerable interval elapses while they crawl about on the cane before they enter the stalk, or midrib of the leaf. A heavy fall of rain during this period would wash them on to the ground, where they would fall an easy prey to natural enemies, especially *Solenopsis geminata* (" hormiga brava ").

480 - ***Phlyctaenodes sticticalis*, Micro-lepidopteron Injurious to Tobacco in Roumania** (1). — KNECHTEL WILHELM R. in *Directiunea Generală a Regiei Monopolurilor Statului, Buletin*, Year III, Part III-IV, pp. 24-39, Figs. 7. Bucharest, 1915

During 1915, *Phlyctaenodes sticticalis* has been found attacking tobacco in the east of Rumenia. It had been previously recorded (1900 and after) as injurious to field crops, particularly tobacco.

(1) See *B.* Jan. 1915 No. 134. (*Ed.*).

The larvae have been reported from various parts of Eastern Moravia and of Northern Dobrugia, especially from the province of Dobrina-Falciu, where they appeared on July 4 in the commune of Cretesti. In this latter place fifteen plantations were attacked, two being completely destroyed. They were also observed in the provinces of Priponesti-Tutova (communes of Ghidigneni and Carlomanesti), Solesti Vaslui, Lipovat Vaslui (communes of Lipovat, Deleni, Munteni, Naujesti) Macin-Tulcea, and Badadag Tulcea. They are commonly known as " Omida Ruseasca ".

The tobacco-leaves are attacked at the margins and gradually devoured until only the skeleton remains. Damp and rainy weather favours the development and spread of the insect, whose attacks coincide with very rainy seasons. Among the natural enemies of *Phl. sticticalis* is a Coccid, *Mikroklossia prima*, already recorded by KRASSILTSCHIK. As means of control, the direct destruction of the larvae and the isolation of infected centres are recommended ; also spraying with insecticides, disinfection of the soil, and burning of all vegetable refuse and of any other infected matter.

481 - **The Pavement Ant (*Tetramorium cespitum*) as a Pest of Coldframe and Greenhouse Crops in Virginia** (1). — SMITH LOREN B. in *Virginia Truck Experiment Station, Bulletin*, 16, pp. 353-365, Figs. 78-83. Norfolk, Virginia, 1915.

During the past two years, horticulturists in the Norfolk region have been suffering losses from the attacks of the pavement ant. This insect is a native of Europe and was introduced into America probably 150 to 200 years ago. Since that time it has become quite widely distributed throughout the Eastern United States ; it is only recently, however, that it has been reported as injurious to vegetable crops.

Two species occur in the above region which might be confused with the pavement ant : the red ant (*Monomorium pharaonis* L.) and the little black ant (*Monomorium minutum* Mayr.) These can be distinguished by their smaller size and difference in colouration.

*T. cespitum* has been observed to feed on the following vegetables : kohl-rabi, cauliflower, cabbage, eggplant, Brussel sprouts, pepper, tomato, radish, parsley and lettuce. The attacks occur on the roots, crown and lower portion of the stem and have been found to be more severe during the spring, autumn and winter seasons.

Where the nests are accessible, fumigation with carbon bisulphide has proved the more efficient method of control. If the nest occurs on the surface of the ground, place a saucer containing a few ounces of the liquid fumigant on the ground over the nest and cover the whole with several thicknesses of heavy canvas. Allow the fumigation to continue for at least 12 hours. If the nest is underground, push swabs of absorbent cotton soaked in the fumigant down into the nest, firmly packing the soil over them.

In case these methods cannot be applied, poison baits may be used (Paris green and bran, or potassium arsenate mixed with orange pulp). Kill-

(1) See also *B.* Jan. 1916 No. 134.

ing the ants with hot water is also an advantageous method and fish scrap fertiliser may be found to have some value as a repellent.

482 - **Staphylinid Injurious to Turnips in France.** — VINCENT in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. II, No. 4, pp. 87-88. Paris, January 26, 1916.

In the localities of the Department of Finistère where turnips are closely cultivated, circular zones may often be observed where the crop is thin and irregular. Some of the plants wither and quickly die off, others are dwarfed and weedy. The leaves and tap root do not show any traces of fungoid disease, but on examining the surrounding soil numerous larvae will be seen which attack and devour the roots.

The larvae are from 3 to 4 mm. long; body creamy white, head black. The black adults bred from the larvae in the laboratory were identified as belonging to the family of the Staphylinidae. This insect is very sensitive to insecticides. Good results were obtained with toluene and still better ones with benzine in the proportion of 8.8 gallons per acre.

However, it would probably be more economical to give up the crop or at any rate to adopt a rotation.

483 - ***Tinea cloacella*, Injurious to Dried Edible Mushrooms.** — KRAUSE ANTON in *Zeitschrift für Forst- und Jagdwesen*, Year 48, No. 2, pp. 73-78, Berlin, February 1916.

On March 22, 1915, the writer received from Eberswalde (Germany) a quantity of dried mushrooms which had been attacked by larvae of different ages.

The first adult insect emerged on April 9, and was identified as *Tinea cloacella*. Most of the adults, however, did not appear till May.

The first mating was observed on May 16. During the mating period, the phototropism of the insects was more strongly positive than usual.

The eggs were always deposed singly on the mushrooms. The writer confined a number of males and females in a cage, together with small bits of mushroom; eight days after, in addition to the eggs, there were a number of young larvae about 1 mm. in length.

It is interesting to note that the insect requires very little water for its development and that many larvae die before pupating, in the same way many others do not survive the pupal stage.

The completely developed larvae are 9 mm. long; the pupae about 5 mm. The bodies of the former are covered with excrescences which resemble closely the hairs characteristic of Lepidopterous larvae. This is a point which should prove interesting from the systematic point of view.

As dried mushrooms become worthless when attacked by *Tinea cloacella*, it is advisable to examine them from time to time, removing all those attacked by the Lepidopteron.

484 - **The "Fruit-fly" (*Ceratitis capitata*) Injurious to Citrus in Greece** (1). — PAPAGEORGIOS P. in *Deltion Vasilikis Georgikis Etaireias*, Year VII, No. 12, pp. 258-260, Fig. 1. Athens, 1916.

*Ceratitis capitata* caused considerable damage in 1915 among Citrus trees in Attica and Epirus. The fruit of lemons, oranges and mandarins

(1) See *B.* Sept. 1915 No. 993. (*Ed.*).

attacked by this insect are unsaleable and often drop to the ground at the slightest breath of wind.

The following means of control are advised :

1) All tainted fruit to be collected and treated with lime, as this kills the larvae and presents the development of subsequent generations ;

2) Tin cans containing sweetened poisonous substances to be hung in the plantations to every 20 th. tree ; good results were obtained by a 5 per cent solution of arsenate of soda added to grape syrup ; the Diptera gather round the cans and, absorbing the liquid, are killed in great numbers.

485 - **The Bagworm (*Thyridopteryx ephemerae-formis*), an Injurious Shade-Tree Insect.** — HOWARD L. O. and CHITTENDEN F. H. in *United States Department of Agriculture, Farmer's Bulletin*, No. 701, pp. 1-11, Figs. 1-13. Washington, D. C., Jan. 15, 1916.

*Thyridopterix ephemerae formis* (" Bagworm " or " Basketworm ") has recently caused considerable damage in the States of New Jersey, Pennsylvania, Maryland, Virginia, West Virginia, Ohio, Indiana and Illinois.

The larvae of this lepidopteron construct themselves a sort of bag with the aid of fragments of leaves cut from trees and held together by means of silk. The anterior portion of the body of the larva remains free and the animal crawls about on the branches and devours the leaves of a large number of plants. Practically all shade trees are attacked and in some years the larvae are found on nearly every species of orchard and forest tree also. They also occur on willows, maples, poplars and mulberry, and less frequently on elms and oaks. They even feed to a certain extent on many low-growing semiwoody plants, such as elder, mallow and ragweed.

Among the natural enemies of this insect are : (*Pimpla*) *Itoplectis inquisitor* Say ; (*Pimpla*) *T conquisitor* Say ; (*Hemiteles*) *Allocota thryidopterigis* Riley ; *Spilochalcis moriae* Riley ; *Chalcis ovata* Say ; *Dibrachys boucheanus* Ratz and *Habrocytus thyridopterigis* Ashm.

The following methods of treatment are advised :

1) Where possible, collect the larvae and destroy them directly.

2) Encourage the development and reproduction of the natural enemies.

3) Spray with arsenicals.

## INJURIOUS VERTEBRATES.

486 - **Comparative Experiments in Austria on the Control of Field-Voles** (1). — STRAMAK FRANZ in *Wiener Landwirtschaftliche Zeitung*, Year 66, No. 5, pp. 26-27. Vienna, January 15, 1916.

An account of experiments carried out at the initiative of the Czech section of the " Landes-Kulturrat " of Bohemia, from March to May 1915, on the control of field voles, making use of various methods. The dry spring weather which was favourable to the reproduction of these rodents

(1) See *B.* Jan. 1915 No. 132 ; and *B.* Feb. 1916 No. 264. (*Ed.*).

was also suitable for conducting the experiments. The plots of ground chosen for the purpose of the experiment were sown with clover except in a few cases where rye was used. Ditches, banks, etc. were also included.

The average number of holes counted in the fields was 5 per square meter and varied from 1 to 10. The fields were invaded to such an extent that all the plants around the holes had been destroyed for a distance of 15 cm. Three or four days before the experiment, the holes were all closed by stamping in the earth. Only those holes which the voles re-opened were used for the experiment.

The results were as follows :

1) PILLS CONTAINING 20 % OF BARIUM CARBONATE. — Five pills each weighing 0.5 gms. were placed in a hole, or between two tiles placed in the open field. During March, 40 holes and 8 pairs of tiles were treated. The pills placed in the holes gave positive results in 70 % of the cases. The pills placed in the open, between the tiles, gave negative results.

2) PHOSPHORUS PILLS. — Four pills weighing 1-1.5 gms. each were placed in each hole. The experiments were carried out during March on 44 holes with two types of pills. The first type gave positive results in 42 per cent of the cases, and the second type positive results in 28 per cent. The same experiments repeated in May gave negative results throughout.

3) PHOSPHORUS PASTE. — Straw was smeared with the paste and placed in the holes. When the voles left their holes some of the paste adhered to their bodies, the rodents then licked themselves and were poisoned. Thirty holes were treated in this way and left open during the whole period of experiment. The voles were usually poisoned after 3 days. The experiments conducted both in March and May gave positive results in 72 cases per cent.

4) ARSENICAL PASTE. — This mixture was composed of arsenious acid, caustic soda, potato meal, water and molasses.

It was employed in the same manner as in the preceding experiments. Thirty holes were treated and both in March and May, 50 cases per cent gave positive results.

5) GRAINS OF WHEAT POISONED WITH STRYCHNINE. — The grains were soaked for 45 hours in a strychnine solution containing 4 gms. of poison (nitrate) per kg. of wheat.

The grain was then sweetened with saccharose or saccharine ; 1 gm. of calcium bicarbonate was then added to the mixture with some fuchsin to restore the grains to their normal colour. The grains were then put into the holes.

Forty holes were thus treated. The experiments made in March gave positive results in 87 cases per cent ; those carried out in May gave similar results only in 7 cases per cent.

6) OAT GRAINS POISONED WITH STRYCHININE. — The husks were first removed from the grains and these latter then treated like the wheat. The experiment was made on 40 holes. In March, good results were obtained in 92 cases per cent ; in May, only in 7 cases per cent.

7) MORPHINE PILLS. — Five pills were placed in each hole which

was then closed. Part of the pills were put out when the weather was dry, and part when it was wet. In the first case good results were obtained, in the second they were negative.

8) Poisoned biscuits. — The poisoned biscuits placed in the vole holes were not eaten.

9) Carbon disulphide. — This was injected into the holes by means of a special apparatus. The result was satisfactory whenever the hole was well filled by the gas. Carbon disulphide is, however, difficult to employ.

10) Sulphur dioxide. — This was introduced into the holes by means of special cartridges invented by the writer.

Finally, experiments were made with traps.

*Conclusions.* — 1) The results obtained by the different methods depend upon a number of factors, such as : the season in which the campaign is conducted, the nature of the soil ; the number of voles in the soil etc. ;

2) During the winter and in early spring, when food is scarce, the best method is that with poisoned grain and particularly the oat-grains treated with strychnine ;

3) Pastes also gave good results, especially the arsenical paste, which has the advantage of being adapted for use in all seasons ;

4) Of the pills, those containing morphine gave the best results.

5) In April and October when the soil is well stocked with food, the employment of gases is advisable.

6) For destroying voles in ditches or banks, etc. the best medium is sulphur dioxide.

487 – **Plague of Field-Voles in the Province of Kieff during 1914.** — Charlemann F. in *Khosiaistwo* (The Farm), No. 45-46, pp. 1058-1059. Kiew, 1915.

In 1914, many provinces of South Russia were very seriously invaded by field voles, while in the spring of the following year the number of these rodents was greatly diminished ; in fact, in some places they had entirely disappeared. In the autumn, when it was possible to form a judgement, from the number of holes, of the extent of the attack, it was seen that this number was not above the normal. The cause of the rapid disappearance of the animals is attributed to weather conditions. The spring of 1915 was a very changeable one. Up till February, the weather was very mild and the snow melted almost everywhere ; in the latter half of the month, however, the cold returned, snow fell once more and the water froze in the fields. This sudden return of winter must have had bad effects on the voles.

After the spring in question, *Microtus arvalis* Pall. disappeared almost completely from the province of Kieff ; *Evotomys glareolus* Scheb. was seen very rarely, and the number of *Arvicola amphibius* L. markedly diminished. The number of other species of rodents also decreased.

In connection with this decrease, the opinion is quoted of K. A. SATUNINE who, when speaking of the distributional centres of voles, says that the problem of the control of voles is confined to the discovery and destruction of such centres during the years in which their numbers are observed to be less.

According to some writers, the vole plagues occur approximately every ten years. If this is admitted, the above advice may well be borne in mind.

ALFREDO RUGGERI, *gerente responsabile*.

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

# INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (*Ed.*).

FIRST PART.

# ORIGINAL ARTICLES

## Dairying in Uruguay

by

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In Uruguay, milk is produced on farms of varying area, either as a part of the ordinary farm routine with dairy cattle, or by more specialised methods the practice of which is confined to certain regions, particularly those near markets. Owing to the local methods of production employed, it is difficult to determine the milk yield in Uruguay. It might, however, be ascertained approximately from the number of dairy cattle existing in the country.

Pending the publication of the "Censo Agropecuario" (Zootechnical and Agricultural Census) which is now being prepared, the only available information is that of the "Censo General de la Republica", for 1908, and which is summarised in Table I.

TABLE I. — *Number of dairy cattle in the various departments of Uruguay.*

| | | | |
|---|---|---|---|
| Artigas | 21 735 | Paysandù | 22 132 |
| Canelones | 39 372 | Rio Negro | 14 589 |
| Cerro Largo | 39 981 | Rivera | 29 257 |
| Colonia | 42 876 | Rocha | 33 097 |
| Durazno | 29 186 | Salto | 32 427 |
| Flores | 10 126 | San José | 29 284 |
| Florida | 40 110 | Soriano | 19 201 |
| Maldonado | 21 880 | Tacuarembó | 43 213 |
| Minas | 38 586 | Treinta y Tres | 43 127 |
| Montevideo | 15 675 | Total | 565 854 |

According to the above mentioned General Census of 1908, the total number is made up as follows :

| | |
|---|---|
| Pure bred cattle . . . . . | 10 775 |
| Cross bred cattle . . . . . | 289 103 |
| Native cattle . . . . . | 205 385 |
| Not classified . . . . . | 60 591 |
| Total . . . | 565 854 |

In reality there is a larger number of pure-bred dairy cattle, besides animals improved by crossing, as will be shown by the Agricultural Census now being carried out.

MILK CONSUMPTION IN RELATION TO THE POPULATION. — The Agricultural department of the " Inspección Nacional de Ganadería y Agricultura " (Inspectorate of National Stock Breeding and Agriculture) has conducted an inquiry on this subject by means of question-papers sent to the " Intendencias Municipales " (Municipalities) of 19 departments, and has obtained for the years 1914 and 1915 data regarding the chief towns and places of importance, but not the rural districts, for which it is impossible to calculate the amount of milk consumed with accuracy. These data are given in Table II.

According to data furnished by the municipal Laboratory (" Officina Municipal de Análisis ") of Montevideo, the average daily consumption of milk in that town is 130.000 l. (228.874 pints), sold by 172 " tambos " (dairies), 105 " despachos de leche " (milk-shops) and 733 " repartos de leche " (localities for the distribution of milk).

For other parts of Uruguay, the figures giving the daily consumption of milk are only approximate, and the difference between summer and winter consumption has been taken into account as much as possible. This difference, which varies according to locality, fluctuates between 10 to 40 % and is due to a larger yield in summer than in winter and to the corresponding variation in prices, which are higher in winter than in summer.

The data given by Rio Negro and Soriano are calculated approximately by their population and by the milk consumption of neighbouring departments.

The average price of a pint of milk in the different departments of Uruguay is given in Table III.

At Montevideo the price of milk varies between 0.05 and 0.12 *peso* (1.42 and 3.4 d. per pint) ; the average price may be considered as 0.08 *peso* (2.37 d.).

BUTTER AND CHEESE MAKING. — For the present this branch is limited to the native demand. Besides the establishments which specialize in this industry, it is also carried on in a great number of " estancias agropecuarias " (mixed farms) where milch cows are kept. These " estancias make a certain quantity of butter and cheese, partly for home use, and partly for selling at wholesale prices to the retailers. In these farms, breeding

TABLE II. — *Milk consumption in relation to the population.*

| Departments | Localities | Pints of milk consumed per day | Population | |
|---|---|---|---|---|
| | | | Departments | Localities |
| 1) Artigas | San Eugenio | 2 112 | 26 321 | 6 000 |
| 2) Canelones | Guadalupe | 3 520 | 87 874 | 4 000 |
| | Las Piedras | 1 408 | | 3 500 |
| | Santa Lucia | 1 760 | | 3 500 |
| | Pando | 1 584 | | 6 000 |
| | San Ramón | 880 | | 4 000 |
| 3) Colonia | Colonia | 3 408 | 54 644 | 5 000 |
| | Nueva Palmira | 968 | | 3 500 |
| | Carmelo | 3 036 | | 4 500 |
| | Rosario | 1 760 | | 3 500 |
| | La Paz | 274 | | 1 000 |
| | Nueva Helvecia | 493 | | 3 700 |
| | Conchillas | 176 | | 2 000 |
| 4) Cerro Largo | Melo | 4 400 | 44 742 | 12 500 |
| | Artigas | 352 | | 1 500 |
| 5) Durazno | Durazno | 8 025 | 42 325 | 13 000 |
| 6) Flores | Trinidad | 4 400 | 16 082 | 8 300 |
| 7) Florida | Florida | 6 691 | 45 406 | 10 600 |
| 8) Maldonado | Maldonado | 2 640 | 28 870 | 3 500 |
| | San Carlos | 4 752 | | 4 000 |
| | Aiguá | 572 | | 2 000 |
| | Pan de Azúcar | 1 348 | | 2 500 |
| 9) Minas | Minas | 1 760 | 51 222 | 13 500 |
| | Battle y Ordoñez | 440 | | 4 000 |
| | Zapicán | 176 | | 1 000 |
| | Solis | 264 | | 2 000 |
| 10) Paysandú | Paysandú | 8 800 | 38 421 | 20 000 |
| 11) Rio Negro | Fray Bentos | 3 168 | 19 932 | 7 300 |
| 12) Rivera | Rivera | 3 520 | 35 683 | 9 000 |
| | Tranquera | 352 | | — |
| 13) Rocha | Rocha | 5 280 | 34 119 | 12 200 |
| | Castillos | 704 | | 1 200 |
| | Lascano | 1 031 | | 2 000 |
| 14) Salto | Salto | 16 720 | 46 259 | 20 000 |
| 15) San José | San José | 6 160 | 46 324 | 13 000 |
| | Rodriguez | — | | — |
| | Ituzaingó | 704 | | — |
| | Libertad | 246 | | — |
| 16) Soriano | Mercedes | 6 688 | 39 565 | 15 000 |
| 17) Tacuarembó | San Fructuoso | 2 816 | 46 939 | 7 546 |
| | Santa Isabel | 1 760 | | — |
| | San Gregorio | 1 056 | | — |
| 18) Treinta y Tres | Treinta y Tres | 4 400 | 28 777 | 7 500 |

TABLE III. — *Wholesale price of milk for consumption in the different departments of Uruguay.*

| Departments | Prices per litre in *pesos* (1) | | | Prices per pint in pence (1) | | |
|---|---|---|---|---|---|---|
| | Summer | Average | Winter | Summer | Average | Winter |
| Artigas | 0.04 | — | 0.10 to 0.12 | 1.14 | — | 2.85–3.4 |
| Canelones | 0.05 to 0.07 | — | 0.07 to 0.09 | 1.42–2 | — | 2.0 – 2.56 |
| Cerro Largo | — | 0.08 | — | — | 2.37 | — |
| Colonia | 0.04 to 0.06 | — | 0.06 to 0.10 | 1.14–1.71 | — | 1.71–2.85 |
| Durazno | 0.05 | — | 0.06 | 1.42 | — | 1.71 |
| Flores | 0.05 | — | 0.06 | 1.42 | — | 1.71 |
| Florida | — | 0.05 | — | — | 1.42 | — |
| Maldonado | 0.04 | — | 0.05 | 1.14 | — | 1.42 |
| Minas | 0.04 | — | 0.08 | 1.14 | — | 2.37 |
| Paysandú | 0.06 | — | 0.08 | 1.71 | — | 2.37 |
| Rio Negro | — | 0.08 | — | — | 2.37 | — |
| Rivera | 0.05 | 0.12 | 0.20 | 1.71 | 3.4 | 5.7 |
| Rocha | 0.04 | — | 0.06 | 1.14 | — | 1.71 |
| Salto | 0.07 | — | 0.09 | 2.06 | — | 2.56 |
| San José | — | 0.06 | — | — | 1.71 | — |
| Soriano | — | 0.08 | — | — | 2.37 | — |
| Tacuarembó | 0.06 | — | 0.12 | 1.71 | — | 3.4 |
| Treinta y Tres | 0.05 | 0.10 | 0.15 | 1.42 | 2.85 | 4.46 |

(1) 1 gold *peso* of Uruguay = 4*s*. 3*d*. at par.

is carried on as well as dairying. Some farms have specialized in the breeding and improvement of dairy-cattle, their chief business being milk production.

In the department of Colonia the milk industry is more extensively developed, there being many places with foreign settlers (*e. g.* Swiss) where flourishing dairy-farms have been established, amongst which are some important " lecherias " and " cremerias ".

The most important places for cheese-making are the departments of Maldonado, Colonia, Tacuarembó and Rocha. The establishments whose chief enterprise is the sale of milk, and who only make small amounts of butter, are mostly in the district round about Montevideo, in consequence, as we have remarked above, of the important market provided by this capital. This region includes several localities situated in the departments of Canelones, San José and in the southern part of the department of Florida. The departments of Soriano and Paysandú may also be added to this category.

As it is at present impossible to give in exact figures the data relative to butter and cheese making in the whole of Uruguay, owing to the manner in which its dairy industry is conducted, we will merely quote the department of Colonia as the most important example from this point of view.

The following figures relating to the department of Colonia are taken from detailed information given by the « Intendente Municipal » (Mayor):

| | |
|---|---|
| Milk-dairies | 30 |
| Milk-dairies — butter-dairies — cheese-dairies | 492 |
| Total number of dairies in the department | 522 |

*Approximate quantities of milk used daily for:*

| | | |
|---|---|---|
| Cheese-making | 123 186 | pints |
| Butter making | 211 176 | » |
| Total | 334 362 | pints |

IMPORTATION OF THE PRINCIPAL DAIRY PRODUCTS. — The favourable conditions for the production of milk and other dairy products in Uruguay, and the fact that owing to its numerous improved and even pure-breed milch cows it is essentially a breeding country, make it possible to foresee that more extensive breeding and growth of forage crops will result in a greater production of milk, and a consequent increase in the amount of butter and cheese available for exportation to the markets of America and Europe. As yet, however, Uruguay is obliged to import these dairy products, as is shown by Tables IV and V.

The amount imported is relatively small, and as Prof. DEMOLIN says in his book "*Lecheria y Cremeria*": "The importation of condensed milk "is admissible in a completely new country, as it forms a substitute for fresh "milk. For this reason, we believe that the descending curve of importa- "tion will correspond to the ascending curve of native milk production. "We should soon reach the day when condensed milk will solely be used "by ships sailing on the water ways in the interior of the country, and "then, only when it is impossible to obtain fresh milk".

As is shown by the figures in Table IV, the amount of butter imported is not large.

On the other hand, the amount of cream imported from Argentina is important and reaches a value of over 40.000 *pesos* (£ 8501). Since 1911, however, the importation of cream has much decreased. In many cases, the importation did not correspond to the real demand, but resulted from the possibility of obtaining the cream at a low price during the period of high production in the neighbouring Country, thus allowing it to compete with the native product. The Customs law in Uruguay allows for this need of the native product and has established protective entrance-duties which will be considered later.

Cheese forms the largest import amongst dairy-products; but it must be remembered that cheese is sold in various kinds and forms and in va-

TABLE IV. — *Importation of the principal dairy products in* 1906-1910 (*yearly average*) *and in* 1911.

| | 1906-1910 | | | 1911 | | |
|---|---|---|---|---|---|---|
| | Quantities in Cwt. | Value in *pesos* | Value in £ | Quantities in Cwt. | Value in *pesos* | Value in £ |
| Condensed milk . . . | 234 | 11 333 | 2 408 | 192 | 5 852 | 1,243 |
| Butter . . . . . | 362 | 11 594 | 2 463 | 120 | 3 901 | 820 |
| Cream . . . . . | 8 879 | 54 128 | 11 503 | 6 939 | 43 301 | 9 202 |
| Cheese . . . . . | 15 345 | 319 694 | 67 940 | 5 243 | 109 205 | 23 207 |

TABLE V. — *Importation of condensed milk in* 1911

| Country of origin | Quantities in Cwt. | Value in *pesos* | Value in £ |
|---|---|---|---|
| Argentina . . . . . | 56 | 1 730 | 368 |
| Belgium . . . . . | 14 | 418 | 89 |
| Germany . . . . . | 56 | 1 721 | 366 |
| Netherlands . . . . . | 29 | 878 | 185 |
| Spain . . . . . | 8 | 236 | 50 |
| United Kingdom. . . . . | 28 | 860 | 183 |
| Totals . . . | 191 | 5 852 | 1 241 |

rious categories, with special characteristics according to the countries of origin. The cheeses imported are generally those selling at high prices. The cheeses manufactured in the country are sufficient for a large part of the demand and are being continually improved. Some good types are produced in the departments of Colonia and Maldonado, and it is quite probable that the Uruguay cheeses will one day be exported in appreciable quantities. In 1914, 252 cwt of cheese was exported, representing a value of 3844 *pesos* (= £ 824).

The imports for 1911 are given in Table VI, and the figures regarding the custom dues exacted for the importation of dairy products are given in Table VII.

To complete the preceding data as to the price of milk in the different departments of Uruguay, we would add that :

The actual price of *new cheese* per kg. varies between 0.23 and 0.40 *peso* (7 ½ d to 9 ½ d per lb) according to category.

*Cream* is valued at 0.70 *peso* per kg. of fatty matter (16 d per lb).

*Butter* is sold wholesale at 0.75 *peso* per kg. (18 d per lb).

LEGISLATIVE MEASURES. — In all the departments municipal regulations exist for the sale of milk, and which control amongst other points the following:

1) Purity of the milk.
2) Prohibition of the sale of skimmed or watered milk.
3) Regulation of carriage.
4) Condition of vessels.
5) Hygienic conditions of sale — Localities — Vessels, etc.
6) Registers of milk-vendors deposited in the Municipal Laboratories.
7) Inspection of "lecherías", "tambos", and "despachos".
8) Penalties.
9) Additional penalties.

The "tambos" are subject to the regulations concerning disinfection and the cleanliness of the cattle, established by the Law on the Inspection of Cattle. The "Sección Tambos y Lecherías de la Oficina de Policía Sanitaria Animal" (Dairy Section of the Office of Cattle Sanitary Police) is responsible for the application of these regulations, in accordance with the corresponding regulations which deal with the following questions concerning the hygiene of the dairy business:

1) Dimensions and hygienic construction of shippons; imperviousness of building materials and conditions of drainage.
2) Removal of manure and the state of the dung-hill.
3) Hay barns.
4) Cleanliness of workmen (prohibiting the employment of persons infected with contagious diseases, or having wounds of an infectious nature on the hands).
5) Notification of disease or of the appearance of symptoms indicating disease, especially udder troubles. Notification of cases of death among the cows, in order that a veterinary examination may be made and suitable measures applied.
6) Measures to be applied in the case of infectious diseases (closing of the establishment, which will only be re-opened when the "Oficina de Policía Sanitaria" is satisfied that all danger is passed). Disinfection of localities and application of the measures enforced by the Police in charge of sanitation.
7) Cleanliness etc, of cows' food (water and forage), of milking and of the preservation of milk.
8) Penalties.

Similar Regulations are applicable to all establishments where milk and its products are sold and made; as, for instance, forbidding the sale: 1) of colostrum and of milk that is stringy, spoilt, bitter, sour, soiled, etc., 2) of milk originating either from unhealthy cows, or from cows fed on spoilt or harmful foods, or such as to communicate a bad taste or foul smell

TABLE VI. — *Importation of cheese in* 1911.

| Countries of origin | Quantities in Cwt. | Value in *pesos* | Value in £ |
|---|---|---|---|
| Argentina | 12 | 256 | 55 |
| Belgium | 106 | 2 220 | 475 |
| Chile | 4 | 80 | 17 |
| France | 151 | 3 144 | 674 |
| Germany | 511 | 10 644 | 1 182 |
| Italy | 3 875 | 80 715 | 17 305 |
| Netherlands | 333 | 6 942 | 1 488 |
| Portugal | 7 | 135 | 29 |
| Spain | 148 | 3 089 | 662 |
| United Kingdom | 94 | 1 957 | 419 |
| United States | 1 | 23 | 5 |
| Totals | 5 242 | 109 205 | 22 311 |

TABLE VII. — *Custom duties on dairy products imported into Uruguay.*

| Products | Estimated value | | Duty per cent of estimated value | Duty by unit weight | |
|---|---|---|---|---|---|
| | *pesos* per kg. | pence per lb. | | *pesos* per kg. | d per lb. |
| 1) Condensed milk (including tin) | 0.68 | 15 | 51 % | — | — |
| 2) Cream * | — | — | — | — | — |
| 3) Butter * | — | — | — | — | — |
| 4) Cheeses (including case) | 0.41 | 10 | — | 0.38 | 9 |
| 5) Miek sugar | 0.50 | 12 | 48 % | — | — |

* The law of June 4, 1913 has provided for butter, and for the cream intended for butter making, the following custom duties per unit of weight.

A. — *Butter of all kinds and origins* 0.60 *peso* per kg (15 d per lb) gross weight.

B. — *Cream* : duty on the *net weight*, up to 50 degrees of fat content per kg. of cream, *maximum* duty 0.15 *peso* (3 ½ *d* per lb) ; *minimum* duty 0.10 *peso* (2 *d* per lb.). — If the cream has more than 50 degrees of fat content, the duty paid is proportional to each degree of increase. The *maximum* duty is exacted when the « cremerias » of the Country are able to obtain sufficient quantity of cream of native production. If, on the contrary, the Executive Authorities are convinced that there is an appreciable scarcity of native cream, then the *minimum* duty is exacted.

C. — *Butter substitutes* (declared uninjurious to health) pay a custom duty of 1.20 *peso* per kg. (28 d per lb).

to the milk ; or finally from cows treated with toxic substances whose action is general.

Milk, butter, cheese and other dairy products must come from establishments subject to sanitary control.

Other regulations concern : the standards to which the milk, cream and cheese sold must conform ; the hygienic condition of milk and its products, for instance, it is forbidden to introduce the milk from one department into another without a permit declaring that it originates from cows that have been given the tuberculin test by the official veterinary surgeon.

The tuberculin test is subject to a special regulation of which the 1st article is as follows :

" All milch animals (cows, asses, goats etc.) belonging to " tambos ", " " lecherias ", or to private persons who keep the milk for their own use, " must be inspected and undergo the tuberculin test by the " Inspección de " Policia sanitaria animal " ; which will give a sanitary certificate or show " in the way it judges best, that these operations have been carried out ".

" The tuberculin test will be applied to all potent males. and other kinds " of animals susceptible to the disease, (kept by establishments, or persons,owning dairy cattle ".

" The owners who do not apply these regulations are liable to a fine " of 10 *pesos* (£ 2. s. 2) or to an equivalent imprisonment ; the penalty " will be doubled in the case of a second offence ".

" In case of resistance from the proprietors the tuberculin test will " be carried out forcibly, without prejudice to the aforesaid penalties. To " this end, the officials of the Sanitary Police, aided by the Public Police, " after having, if necessary, forced an entrance into the property of the " resisting owner, will take possession of the animals, giving the proprietor " a proper receipt for them, will perform the tuberculin test, and then " return them to the owner ".

Cooperative Movement. — Cooperative societies as yet do not play an appreciable part in regard to milk production, or the sale of dairy products ; up to the present, one society alone has been formed, which we mention as an experiment in this line of cooperation. Speaking generally the cooperative movement has only recently begun in Uruguay but it is favourably received, the many advantages of cooperation being fully realized.

In concluding, we express the hope that the dairy industry in our Country will give a new impulse to the cooperative movement.

SECOND PART.

# ABSTRACTS

## AGRICULTURAL INTELLIGENCE

### GENERAL INFORMATION.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

488 - **Agriculture in India.** — MACKENNA JAMES, *Agriculture in India*, 106 pp. Calcutta 1915.

This work consists of XVI Chapters, the contents of which may be summarised as follows :

I. — *Historical.* — The annual value of the agricultural produce of British India has recently been estimated at roughly £ 1 000 000 000. More than $^2/_3$ of the inhabitants are engaged in agriculture or in the industries subsidiary to it. In spite of the importance of agriculture to the national economy of India, there was no Department of Agriculture formed until 1880. In 1878, the terrible famines decided the British Government to send a Commission to India to study the best measures to be taken for the improvement of agricultural conditions. On the advice of the Famine Commissioners, there was formed, in 1880, a Department of Agriculture under the guidance of Sir Edward Buck, (now Delegate of India at the International Institute of Agriculture, Rome). In the first place, it was necessary to : 1) organise the survey ; 2) compile statistics of production : 3) institute enquiries as to the local agricultural conditions in the different districts of India. The data thus obtained and supplemented by the isolated and interrupted work of some scientific workers appointed by one or other of the Provinces, or working on their own initiative with the view of assisting some special branch of agriculture, laid a solid foundation for the systematic studies and researches afterwards undertaken by the Staff of the Agricultural Department. In 1901, an Inspector General of Agriculture was appointed, and a staff of scientific workers recruited. For the latter, there were provided at Pusa, in the district of Bihar, an agricultural research institute, an experimental farm, and an agricultural college. No regular course of instruction is given at the Institute, but the

graduate who has completed his general agricultural education can specialise in one branch under the personal supervision of an expert. In the financial statement of 1905-1906, it was announced that the Imperial budget would allot the sum of 20 lakhs (subsequently raised to 24 lakhs) to the improvement of agriculture. Colleges were accordingly reorganised, or started, at Poona, Cawnpore, Sabour, Nagpur, Lyallpur and Coimbatore. To these Agricultural Colleges were attached provincial Research Stations and Experimental Farms. At the present time, 29 agriculturists, 9 agricultural chemists, 8 economic botanists, 3 agricultural engineers, 1 entomologist and 1 mycologist are employed at these provincial establishments.

II. — *Organisation and Work of Provincial Departments of Agriculture.* — In each of the 9 provinces, agricultural and veterinary work is under the control of a Director of Agriculture. In the provinces where there are agricultural colleges, the scientific officers are stationed at the College, and have their laboratories, herbaria, etc, there. Attached to the college, is a farm used for training students in practical agriculture, and where the improvement and selection of cultivated plants, manurial experiments etc., are carried out. The results obtained are brought before the notice of the native agriculturists by the Demonstration Farms. Finally, at the seed Farms, the improved seed is grown for distribution to the native farmers.

Deputy Directors, aided by a staff of Indian Assistants, control the experimental, demonstration and seed farms. This method of working has already greatly improved many of the chief crops grown in India.

III. — *Crops:* 1) *Cotton.* — The area under cotton has increased more than 67 per cent in the course of the last 20 years, and at the present time, represents over 6 per cent of the total cultivated area of India proper. The cotton crop of 1913-1914 was estimated at over 5 million bales. Of this crop, nearly 3 million bales, worth more than 27 million pounds sterling, were exported. In Madras, during the last 20 years, the area under cotton has increased by a million acres ; in Bombay, by nearly 1.5 million acres ; in the Punjab, by 900 000 acres ; in the Central Provinces and Behar, by over 1.5 million acres, while the native states show an increase of nearly 1.5 million acres. In Bombay, the United Provinces and the Central Provinces, attempts have been made from the earliest days, but with little success, to introduce foreign varieties of cotton. Subsequently, the indigenous cottons of India were surveyed by the Imperial Cotton specialist, and aided by the data obtained, the provincial officers proceeded to isolate and maintain pure types, to improve quality by selection, and introduce the improved plant into general cultivation. By this means, varieties with higher yield and larger lint percentage were obtained in the Presidencies of Bombay and Madras, in the Central Provinces, and the United Provinces. At the same time, an attempt was made to introduce exotic varieties, especially into districts where they had not been cultivated before ; thus Egyptian and Upland American cottons have been introduced into Sind ; American varieties have been established in Bombay, the Punjab

and the United Provinces, and 1 type of "Upland Georgian" in the Central Provinces, but the greatest achievement has been the introduction of "Cambodia" into the Presidency of Madras. Experiments in the improvement of agricultural practice, in cultivation, crop rotation and on manures are being carried out on experimental farms, and the results, when proved, are being introduced into general practice.

2) *Wheat.* — About 10 per cent of the total cultivated area of India is under wheat, and about 15 per cent of the total area of cultivation in the native States. In the last 5 years there has been an all round increase of about $8\,^3/_4$ million acres, while in 1915, there was a further increase of 6 million acres. As it was found that all the varieties of wheat grown in India were peculiarly liable to rust, many attempts were made to introduce Australian, English and North American wheats, but without success, because these varieties mature too late, and the growing season of wheat is relatively short in India.

Lately, M^r^ and M^rs^ Howard have selected at Pusa, 25 types of Punjab wheats which are distinguished for their high yield. They are now trying to obtain, from these types by selection, and by crossing with foreign varieties, wheats with standing power, rust resistance and high gluten content (the latter being required by the British market). Satisfactory results have already been obtained and as it has also been found that these varieties of wheat do well in other parts of India, it has been proposed to increase the amount sown on a large number of the Punjab seed farms, In order to distribute the selected seed throughout the wheat growing districts of the country.

3) *Rice.* — This cereal is predominant in the Eastern Provinces and Burma. The area under rice exceeds 80 million acres, which represents 35 per cent of the total cultivated area of India. In Assam, nearly 80 per cent of the cultivated area is under rice, in Burma, 74 per cent, and in Bengal, 70 per cent. The varieties of paddy are numerous, and this makes selection and the improvement of methods of cultivation a very difficult task. Nevertheless, the efforts already made have been successful from the points of view of yield and nutritive value. At the present time, the work of selection is chiefly based on the shape, colour, uniformity and consistency of the grain. The work is being carried out upon irrigated and non-irrigated rice varieties ; spacing and manurial experiments are also being conducted in all provinces. The general experience seems to be in favour of green manuring for transplanted paddy ; bonemeal is, however, in many provinces, reported to give good results. Other experiments have been made as to the dates of ploughing and sowing, the amount of seed to be used, and the number of young plants to be planted out. The control of insect pests and fungus disease has also been begun, but it is rendered difficult by the vast size of the tracts affected.

4) *Sugar cane.* — As a result of foreign competition, there has been a considerable diminution of the area under this crop during the last 25 years, notably in Bengal, Bombay and the Central Provinces, but as a set-off, there have been large increases in Madras, the United Provinces and

Assam. The total area under sugarcane in 1913-14 was 2 519 800 acres, of which the United Provinces contributed 1 379 900 acres and the Punjab 411 200. In Southern India, varieties with thick, fine canes and high sugar yield are grown, which do not do well in Northern India. In Southern India, cultivation is much more intensive, heavy dressings of manure being given, but though the quality is good, the crop is unimportant and the area under sugarcane is very small. A parasitic disease, known as " red rot ', does great injury every year to the sugar plantations. It is therefore necessary to obtain by selection and crossing, richer canes giving higher yields; possessing greater resistance to disease, and yet adapted to the methods of the native cultivator. Such is the work on which Dr Barber has been engaged at his own research station at Coimbatore ; the Experimental Farms of the United Provinces, Bihar and Assam have also been occupied with the same problem, and considerable results have already been obtained in this direction. Further, much has already been done in improving the sugar making machines, and in devising a machine that will be suitable for sugar making on a small scale by small cultivators, or groups of cultivators.

5) *Jute.* — India is the only country which produces this plant on any scale, and its cultivation is limited practically to Bengal and Assam. The area under jute has averaged, in recent years, about 3 million acres. During the last 10 years, the number of jute mills in Calcutta has increased from 38 to 66. Extensive trials have shown that the successful cultivation of jute is quite possible over a wide area outside the jute-growing districts and that in Burma, Assam and North Bihar, the area is capable of a large extension. The selection of some of the cultivated types, which has been carried out since 1906, the year in which Finlow began his study of the jute cultivated in India, has furnished some pure lines possessing high yielding power, strength and durability. Some of these pure lines have been grown and seed is now available for distribution. It is hoped that it will be possible to simprove these varieties till further by the help of hybridisation. Manurial experiments at Burdwan and elsewhere have shown that in addition to cow-dung, oil-cake and green manures (*Vigna Catjang*) can be profitably applied.

6) *Other fibrous plants.* — Flax, Sunn hemp and *Hibiscus cannabinus* (Bombay hemp) occupy about 800 000 acres. These plants have also been improved by selection. Some entomological and mycological enquiries regarding the Coconut palm, which is cultivated on the West coast of Madras and in the maritime tracts of Lower Burma, have resulted in much practical advantage.

7) *Indigo.* — Twenty years ago, the area under indigo was well over a million and a quarter acres ; it is now only 131 700 acres and steadily decreases. With a view to rehabilitating the industry, the Java indigo plant was introduced in 1898, but in 1907 it was attacked by some unknown disease which killed the plant before the seed set, so that for some time it was impossible to improve the qualities of the plant by selection and crossing. Mr Howard, however, discovered later that it was not a question of a

disease properly so-called, but that the wilting of the plants was due t long-continued wetness of the soil, and to the bad cultural methods employ ed by the natives, who always remove all the leaves from the plant a once. Proper aeration of the soil is essential, and a full supply of air t the roots, and especially to the nodules of the roots, is necessary for th production of a crop of good indigo plants seed for selective purposes.

As selection based upon *indican* content is too difficult and delicat a process ; those plants which grow more rapidly and robustly and carr more leaves than the bulk of the crop, are grown apart, in order to obtai a type producing a high *indican* content. To improve the cultivation, i is recommended to harrow back after the removal of the cover crop, t prune instead of cutting back, and to remove the crop after the 2nd cut By these methods, it is hoped that it may be possible to restore indigo cul tivation to its former flourishing condition.

8) *Tobacco.* — Several promising varieties have been isolated, an it still remains to fix their qualities by hybridisation ; the methods of cul tivation have also been improved.

7) *Oleaginous plants.* — A certain amount of selective work has al ready been done on rape and sesame ; the latter crop covers something like a million acres in Burma. The ground nut was introduced into Indi in 1902, and has expanded with much rapidity, now being regularly grown in the arid zone of the country and in the United Provinces.

10) *Tea.* — This plant was introduced into India about 1836. The industry has, generally speaking, prospered from that date, while betwee 1886 and 1910 the area under tea only increased by 98 per cent, the produc tion in the same period increased by 266 per cent ; this was due to the scientific workers employed by the Indian Tea Association and the United Planters' Association of southern India.

11) *Coffee.* — Coffee-growing dates from the beginning of the 19th century ; the industry is practically confined to the Madras Presidency, Mysore, Coorge, the Wynaad, the Nilgiri, Pulney and Shevaroy Hills. It does not enjoy the same prosperity as tea, for it encounters very severe competition from Brazilian coffee.

12) *Rubber plants.* — Rubber is a crop which is coming into prominence, especially in Burma and Madras. The exports in 1913-14 were valued at over half a million sterling.

13) *Fruit-growing.* — This industry has not been neglected, and much has been done, especially at Quetta and Peshawar, to improve the varieties cultivated, and to introduce better methods of fruit packing and transport.

IV. *Silk.* — The silk industry is comparatively insignificant, and tends to decrease on account of the competition of other countries, especially Japan. Nevertheless, an attempt has been made to increase the production by the introduction of better methods of rearing the silkworms, and the improvement of the loom used in silk manufacture.

V. — *Irrigation and Drainage.* — Considerable progress has been

made of late in these directions, especially in Madras, Bombay, the United Provinces and the Punjab.

VI. — *Scientific Research.* — Much work has been done in the various branches of agricultural science, especially at the Central Research Station at Pusa, but also at the Provincial Stations.

1) *Chemistry:* The use of phosphatic manures on Indian soils ; the properties of alkaline soils ; the water requirements of some Indian crops ; the formation and movement of nitrates in the soil ; the chemical composition of sugar-cane, sugar-beet, milk, date-palm sugar, the composition and nutritive value of Soy beans, rice etc, etc.

2) *Mycology:* Preliminary survey of the important fungus diseases of Indian crops ; methods of controlling plant diseases.

3) *Entomology:* Collection and study of the habits and life-histories of Indian insects. Methods of controlling the insect pests of plants and animals.

4) *Agricultural Bacteriology:* Bacterial activity in the soil (the soil conditions affecting the supply and utilisation of combined nitrogen ; the production in, and elimination from the soil of plant toxins) ; the study of bacterial plant diseases ; the action of bacteria in milk.

VII. — *Agricultural Education.* — Agriculture, as such, is no longer taught in the primary and secondary schools, for it is now agreed that rural education must be general, and that it is necessary to develop the pupils' powers of observation ; this, however, does not prevent the use of text-books dealing with familiar objects connected with agriculture.

In the secondary schools, great importance is attached to knowledge of English, to nature study, and practical instruction in the rudiments of chemistry and botany, in order to enable the pupils to profit by the courses at the Agricultural Colleges. The Government of India no longer insists upon a " standard " curriculum in the latter, but leaves the Province free to frame its own scheme of agricultural education with reference to the stage of general educational development and agricultural research that may have been reached. Lately, a native agricultural school has been started in Bombay. This school takes boys from 14 to 16, the course is thoroughly practical and lasts 2 years, while general education is continued, together with specia' instruction in agriculture.

VII. *Veterinary Matters and Cattle.* — The Civil Veterinary Department in India was constituted in 1889 ; it consisted principally of the military veterinary officers of the horse-breeding establishment. Since 1901 the Staff has been recruited from veterinary colleges in England. The provincial organisation consists of superintendents, who are members of the Civil Veterinary Department ; deputy superintendents ; inspectors, and veterinary asssistants. These are now 909 assistants, 95 inspectors and 19 deputy superintendents. There are veterinary colleges at Bombay Lahore, Calcutta and Madras, and a veterinary schoool at Rangoon. The teaching is of a thoroughly practical type and the results are very gratifying. Continous research work is concentrated at the Imperial Bacteriological Laboratory at Muktesar and a branch laboratory has been opened

at Bareilly. The chief work consists in preparing vaccines and sera, espe cially anti-rinderpest serum.

*Cattle-breeding.* — In accordance with the views expressed at th last meeting of the Board of Agriculture, the production of " a dual pur pose animal " (one combining draught and milk) should be aimed at b crossing native cattle with the best European breeds. — In many provinces cooperative cattle insurance societies have lately been started.

Mr MACKENNA'S report deals with the ten years period 1905-1915. I the last chapter, he refers those persons who are desirous of obtaining mor complete and detailed information regarding agriculture in the Indian Em pire, to the publications of the Imperial Department. These can be ob tained from Messrs Thacker, Spink and Co. Calcutta, and are entitle *" Agricultural Journal of India ". — " Proceedings of the Board of Agricul ture in India " — " Report and Memoirs of the Agricultural Research In stitute, Pusa ".*

Mr Mackenna estimates that the increase in the value of the agricul tural products of India, as a result of the labours of its Agricultural Depart ment is already over £ 2 300 000. The last decade has also seen the rapi growth of the cooperative credit movement — that great factor in all sche mes of economic development.

The writer concludes his report by reminding his readers that the motto of the Department of Agriculture should be ; " Sympathy and Coopera tion ".

RURAL HYGIENE

489 - **Notes on the Period preceding Oviposition in the Domestic Fly.** — HUTCHINSON R. H. in *U. S. Department of Agriculture, Bulletin* No. 345, pp. 13 + 1 diagram, Washington D. C. February 5, 1916.

During recent years, the destruction of house flies (*Musca domestica* L.) especially in the spring, has been regarded as the means of reducing the future generations. The apparent justification for this method of contro was based on published records of experiments and observations indicating a rather long period of time between the emergence of the adult fly and the first deposition of eggs, (the socalled " pre-oviposition " period). As the scientific data from which this theory is deduced are founded upon a somewhat meagre scientific basis, some experiments on this subject were carried out at Arlington Va (1913) and at New Orleans La. (1914) ; while collaborators made other experiments. Flies kept in cages were used and the results obtained led to the following conclusions :

The shortest record for the period preceding oviposition was about 2 ½ days ; the usual length was from 4 to 5 days.

Temperature has a very decided influence on the length of the period ; thus at 28° F. (11° C.) the period was shortest and at 18° F. (4° C.) it was longest.

Other factors influencing this period are : humidity ; the kind and quality of the food of the adults ; the kind and quality of the larval food with its resulting effect on the size and physiological condition of the adults.

In the experiments with isolated pairs of flies, very few results were obtained, only 7 out of 30 laying a few eggs, which suggests that the associa-

tion of a number of females in the process of egg laying is the normal habit and that isolation has an inhibiting effect.

Copulation was observed as early as the 1st. day after emergence and as late as the 47th. day. No copulation was noted when the temperature of the air was below 55° F (12° 7 C).

The maximum record for longevity was 70 days and the minimum 1 day, or less. The average length of life for some 3000 flies was slightly over 19 days.

## CROPS AND CULTIVATION.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

490 - **The Effect of Phosphoric Acid Upon the Decomposition of Sugar in the Soil.** — HERKE S. in *Kiserletrigyi Kozlemények* (Communications of the Hungarian Agricultural Stations) Vol. XVIII, Parts 5-6, pp. 857-884 + XXII Plates (Summary in German on pp. 885-886), Budapest, 1915.

The decomposition of the sugar present in the soil as shown by the liberation of carbonic acid, is influenced by the chemical composition of the soil and by the presence of certain salts which are suitable for plant-food. Thus, in a soil to which phosphoric acid has been added, the sugar breaks up more quickly (*i. e.* more carbonic acid is liberated for a certain time), than in the same soil without the addition of phosphoric acid. If the amount of carbonic acid liberated daily from the first and the second soil is estimated, it will be found that the difference between these amounts increases for a certain time, and then decreases.

According to these experiments there seems to be a certain correlation between the effect of the phosphoric acid on the decomposition of the sugar (liberation of $CO_2$) and the larger yield which it produces in manurial experiments. Thus, in a soil where the addition of 0.06 gr. of $P_2O_5$ per kg. had increased the yield of oats and mustard, the same amount of $P_2O_5$ had increased the amount of $CO_2$ given off in the presence of sugar (2 per cent of dextrose or saccharose). It was found that the more the phosphatic fertilser had increased the yield of these plants, the larger also was the difference between the respective totals of the $CO_2$ liberated. Increasing quantities of $P_2O_5$ gradually increased the liberation of $CO_2$ and there resulted a very regular increase in the difference of the above-mentioned totals.

The energy of the liberation of $CO_2$ is affected by numerous factors which modify the action of the phosphoric acid. Thus, the presence of carbonate of lime ($CaCO_3$) promotes the decomposition of the sugar. — Sulphate of ammonia $(NH_4)S_2O_4$, at the rate of 0.05 gr. of nitrogen (N.) per kg. of soil, has also a favourable effect, which however is influenced by the nature of the soil. Small quantities of nitric nitrogen, (0.05 gr. N., in the form of nitrate of sodium ($Na\ NO_3$) per kg. of soil) also increases the liberation of $CO_2$ in the presence of sugar; however, in a nutritive solution, 0.1 % of $Na\ NO_3$ exercises an inhibiting effect. Sulphate of potassium

($K_2SO_4$) also increases the liberation of $CO_2$ in certain soils, while it decreases them in others.

In short, the above-mentioned effect of phosphoric acid is differently influenced by the addition of nitrogenous and of potassic compounds according to the nature of the soil. As a rule, any quantitative variation in one of these nutritive substances modifies the action of the other.

491 - **The Value of *Saccharum spontaneum* in Binding Moving Sands in Sicily.** — Borzi A., in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. II, Part 4, pp. 189-213, 6 figs, Palermo, 1916.

The chief object of this article is to draw the attention of the cultivator to certain species of Gramineae which experience has shown to be very useful in the improvement of the condition of the sands of the coast in some parts of Sicily ; this is done by listing the characteristics of these plants from cultural and biological stand-points, and showing how they may be more widely used.

Amongst these Gramineae, the first place for utility in binding together the sands of the southern districts belongs to *Saccharum spontaneum* L. (= *Saccharum aegypticum* Wild) which perhaps represents the original wild form of the sugar cane. On the north coast, and at some ploces on the east and south coasts of Sicily, *S. spontaneum* is often found, usually cultivated, but sometimes having reverted to a wild state. It provides a shelter for the fields and kitchen gardens against the sea winds. Its cultivation dates back several centuries, especially in the country round Messina, where the plant was probably introduced from Egypt. *S. spontaneum* is a perennial growing throughout the year ; its stems attain a height of 4.92 ft. or with its leaves, of over 9.84 ft., while in garden soil its roots are usually no longer than 11.7 in., but in loose sandy soil they can attain a length of 6.56 -- 9.84 ft. In garden soil, the radius of the rhizomes never exceeds 11.7 in. in one year, but in sand they can grow to a length of 8.2 ft. so as to occupy an area of 23.839 sq. yds. and more ; this plant, therefore, spreads considerably over the sands.

Owing to the combined effects of the torrents and the sea, the northern coast of Sicily is continually extending, so that in periods varying from 10 to 20 years, according to the locality, a strip of an average width of 82 ft requires reclaiming. After marking out the area to be reclaimed *S. spontaneum* is planted in lines perpendicular to the direction of the prevailing winds. The planting is effected in the cool season (from Autumn till April), by means of pieces of cane from 13.65 in. to 15.6 in. in length, with 2 to 4 nodes. The small canes are planted 11.7 in. deep and from 7.8 in. to 11.7 in. apart, in squares. The sand driven by the wind is held up by the plants which quickly take root and grow rapidly. A dyke is thus made that attains its full height (as much as 4.92 ft.) in from 3 to 4 years, and forms an efficient and permanent protection for the land behind it, which is usually devoted to vine-growing.

In order to make this protection more certain and to permanently prevent the surface of the dyke being disturbed by the winds on the interior slope, plantations are made of *Opuntia amyclaea* and *Agave americana*

on the landward slope. This is often unnecessary, as the surface becomes covered naturally by different wild plants, the most common being *Cynodon dactylon, Panicum repens, Dactyloctenium aegyptiacum, Andropogon hirtum, Medicago marina, Lotus cytisoides, Eryngium maritimum, Paronychia argentea*, etc. Of these plants, *C. dactylon* is the one which is most adapted for binding the soil together.

492 – **Cover Crops for Porto Rico.** — KINMAN C. F., in *Porto Rico Agricultural Experiment Station, Bulletin* No. 19, 32 pp., 8 plates, Washington, January 22, 1916.

TILLAGE AND METHODS OF CULTIVATION

The term " cover " crop is used to designate a crop to be grown on soils devoted to horticulture in order to get rid of wild vegetation, to prevent surface washing, to shade and enrich the soil, and to improve its mechanical condition.

The land devoted to horticultural crops in Porto Rico is very deficient in humus and greatly damaged by surface washing. Save during the past 10 years, cover cropping was practically unknown in Porto Rico, and was only introduced after the American occupation of the island. There is a great difference in soil types and local weather conditions in Porto Rico which makes the selection of a cover crop giving satisfactory results a matter of great importance. The work of testing and securing plants for cover crops has been carried on for a number of years by the Porto Rico Agricultural Station. Most of the testing and cultural work has been conducted at the Station itself at Mayaguez. The most suitable plants (together with a number of others which appear to be less promising) have been cultivated in other parts of the island, in cooperation with plantation owners.

The writer discusses the habits of the cultivated plants he recommends as cover crops for Porto Rico ; namely :

« Cowpea » (*Vigna catjang*, or *V. sinensis*) ; « Jack Bean » *Canavalia ensiformis* ; « Sword Bean » (*C. gladiata*) ; « Lyon Bean » (*Stizolobium niveum*) ; « Bengal or Mauritius Bean » (*Stizolobium aterrimum*) ; *S. cinereum S. velutinum* ; « Florida Velvet Bean », (*S. deeringianum*) ; « Pigeon Pea », or « Gandul » (*Cajanus indicus*). Of the wild plants growing in Porto Rico which are worthy of protection and of cultivation in orchards, the writer describes the following :

« Mani cimarrona » (*Chamaecrista diphylla*) ; « Matraca » (*Crotalaria retusa*) ; Zarzabacoa galana, (*Desmodium adscendens*) ; « Zarzabacoa común » (*Desmodium incanum*) ; « Habichuela cimarrona », (*Phaseolus adenanthus*) ; « Yerba rosario » (*Aeschynomene americana*) ; « Conchita peluda " (*Centrosema pubescens*) ; " Tamarindillo " (*Cassia chamaecrista*); " Habichuela parada " (*Phaseolus semierectus*) ; " Mato de la Playa " (*Canavalia obtusifolia.*)

*Vigna Catjang* is grown in all parts of the island, it has the shortest growing period of any of the leguminosae described by the writer. It is valuable as a cover crop and for forage.

*Canavalia ensiformis*, although recently introduced, is in more general use than any other cover crop. It thrives on all except very light soils and on account of its habit of growth, is very desirable in citrus orchards.

*Stizolobium niveum*, *S. aterrimum*, and a number of recently introduced

velvet beans, succeed well on all types of Porto Rico soils where horticultural crops are grown. They are suitable for growing in open fields, or for general use (forage, green manure, seed) where care is taken to prevent injuries through the rank-growing vines choking out other plants.

*Cajanus indicus* succeeds well in all parts of the island. It is cultivated as a cover crop and wind-break, and also for its edible seed. Under favourable conditions, the plants continue their growth for a few years.

The thrifty annual leguminosae which are growing wild, are valuable and should be protected and encouraged. They reseed themselves and are very resistant to drought and heavy rainfall.

The humus in Porto Rico soil devoted to citrus culture soon disappears when clean cultivation is practised. The soil and climatic conditions favour the use of cover crops throughout the sections where citrus fruits are grown.

In old coconut groves where there is a good "stand" of trees, the dense shade prevents a thrifty growth of cover crops. In young groves, or where the "stand" of trees is poor, *Stizolobium*, *Canavalia ensiformis* and *Vigna Catjang* are satisfactory cover crops. *Vigna catjang* and *Cajanus indicus* are used both as catch and cover crops in coconut groves.

*Cajanus indicus* and *Canavalia ensiformis* hinder the growth and production of *Cabezona* and "Red Spanish" varieties of pine apple when planted in the bed with them. *Cajanus indicus* was more harmful than *Canavalia ensiformis*, and the development of the "Cabezona" variety was retarded more than the "Red Spanish".

Cover crops make their heaviest growth and serve their purpose best when planted in spring, or early summer.

Nodule-forming bacteria are present in most Porto-Rico soils: when the bacteria are wanting, inoculated soil should be scattered over the field at the time of seeding the cover crop.

MANURES AND MANURING

493 – **The Respective Values of Organic and Inorganic Manures.** — HODSOLL H. E. P. in *The Journal of the Royal Horticultural Society*, Vol. XLI, Part 2, pp. 217-226 London, December 1915.

The writer examines the results of manurial experiments made at Rothamsted showing the superiority of organic nitrogenous and phosphatic manures over inorganic manures, especially in the case of crops like wheat and swedes which remain longer in the soil. He discusses the factors, mechanical, chemical and biological which account for this superiority of organic manures. Reference is also made to the recent American theory of the sterilising effect of mineral manures. From a consideration of general effects of both classes of manures he makes the following practical conclusion:

Organic manures are useful to supply humus, which improves the soil texture and assists cultivation; to give a gradual supply of food to the crop, which promotes healthy growth and good quality; and to provide humus to feed the soil bacteria.

Mineral manures are useful as a top dressing for rapid growth and to act as a steriliser to keep the bacterial flora in balance. They tend to produce

an unnaturally quick, soft and sappy growth, which should be avoided in the case of permanent crops like fruit, but which is exactly what is required in green crops like cabbage, lettuce, etc. because in addition to giving earliness they also produce a tender leaf.

194 – **The Reclamation of Bog Land in Ireland** (1). — *Journal of the Department of Agriculture and Technical Instruction for Ireland*. Vol. XVI, No. 2, pp. 229-236. Dublin, January 1916.

Pot experiments on the manurial treatment of unreclaimed bog were started in 1913 and followed by field experiments in 1914. These experiments showed the importance of a complete mixture of artificial manures and lime. Nitrogen was more important than potash, except in the case of grain crops.

During last year raw peat from six different bogs was tested in pots, and plot experiments were made on two bogs, one in King's County and the other in County Tyrone.

In the pot experiments, mustard was grown in each case. The following fertilisers were applied in groups of three : nitrogen as nitrate of soda and sulphate of ammonia, superphosphate, kainit, and burnt lime.

In no case did any seedlings grow on the untreated soil, and in only two cases did any growth appear in the pots without lime. With two exceptions, the influence of phosphate was more important than nitrogen and it invariably happened that potash was the least important of the four ingredients. Potash appears to be of less importance in the case of cruciferous crops and others grown for stems and leaves only ; but when it comes to the formation of grain or of tubers, the effect of potash is most marked.

The results of the field experiments with the various crops were as follows :

*Rape.* — On the no-lime plots, the rootlets appeared as if burnt up as soon as the seed germinated, and on the plot without phosphate most of the seedlings died soon after germination. There was considerable growth in the no-nitrogen plot, but the absence of potash appeared to be the least important factor.

*Rye.* — In the absence of lime or of phosphate, only a few stunted ears without grain were produced. The absence of nitrogen did not show such marked results and the grain was of fair quality. Potash made no difference in the early stages, but when the ears were formed the difference was most marked. In the absence of potash, the grain was shrivelled and the straw soft as if thrashed.

In the case of a wet bog, the absence of nitrogen from the mixture was as marked as the absence of potash.

*Potatoes.* — All the plants produced tubers, even in the untreated plots where only a few stalks appeared above ground. The absence of phosphate appeared to be more important than the absence of lime. The want of

(1) See also *B.* Dec. 1915, N. 1255. (*Ed.*).

potash was more marked than the want of nitrogen. The plot receivin the complete manure with lime was far superior to any other and yielde 6 ½ tons per acre. Although a large percentage of the tubers were small, thi yield is very satisfactory considering that growth was checked by a frost o June 19th. On wet bog land, lime appeared to be more important than phos phates and nitrogen than potash.

Pot experiments were carried out to test the value of shell sands an marls in replacing burnt lime. The crop grown was mustand and each po received the same quantity of nitrogen, phosphate and potash. The fol lowing substances were compared : burnt lime, marl, shell sand, peaty marl gravelly sand.

The quantities used were : burnt lime ½ per cent, marl and shell san 1 ½ per cent, gravelly sand 4 ½ per cent.

The marls and shell sand gave quite as good, if not better, result than the lime. They acted as quickly from the very start and effectively corrected the acidity.

495 – **The Utilisation of the Nitrogen of Stable Manure in Relation to the Date of it Application.** — SABACHNIKOW A., in *Selskoie Khosiastwo i Liesowodstwo* (Agricultur and Sylviculture), Vol. CCXLIX, pp. 499-512. Petrograd, December 1915.

In attempting to answer the question as to how long stable manure should remain in the soil in order for it to give the maximum amount of nitrogen in an assimilable form, the writer reviews the results of experiments made on this subject both in the laboratory and field by the best known Russian and foreign experimentalists, and describes in detail the results obtained at the Agricultural Stations of South Russia. — The critical examination of these numerous data has led the writer to the following conclusions.

1) No complete explanation has, so far, been given of the action of temperature, humidity and aeration upon the biological processes taking place in the manure between its application to the time of sowing, and which determine the period during which it is necessary for the manure to remain in the soil, so that the nitrogen may be most fully utilised.

2) The results of the laboratory experiments obtained in different investigations show that the utilisation of the manure increases and the injurious effect of the straw decreases in proportion to the time they remain in the soil.

3) So far, there exist no results, obtained in the field, which can give a decisive answer to the question. The results obtained by the Agricultural Stations of South Russia sometimes contradict those obtained in the laboratory, but this contradiction is due to the fact that in this region, damp is the *minimum* factor with reference to the other growth factors ; it therefore plays a much more important part than the latter and masks the effect of the stable manure.

4) It would be better to carry out experiments on this subject in the following manner : to dig the manure into the black fallow (which is cultivated in the autumn) at the following times ; autumn-spring (April and May) — summer (June and August) and to divide the land into different

ts, noting the effect of the manure during a certain number of years and s action upon the crops cultivated.

Deducing a conclusion from available data, it would appear that the uestion as to the complete utilisation of the nitrogen of stable manure in nnection with the time of its application, still remains an open one.

96 – **" Rhenaniaphosphat ", a new Phosphatic Fertiliser Containing Potassium manufactured in Germany.** — REMY Th, (Bonn University) in *Illustrierte landwirtschaftliche Zeitung*, Year 36, No. 25, pp. 178-179, Berlin, March 25, 1916.

For some weeks, a German Society (" Bezugsvereinigung der deutchen landwirte) " has been offering a new phosphatic fertiliser to agriculurists, which is manufactured at the " Rhenania S. A. " factory at Stolerg under the name of " Rhenaniaphosphat " by the process of Dr. Meserschmidt, which has been patented in Germany. Since 1913, the " Institut ir Boden und Pflanzenbaulehre " of Bonn University has carried out anurial experiments with this new fertiliser, and has obtained such satisactory results that the writer recommends it as a substitute for superphosphate or Thomas slag.

From the chemical point of view, the fertiliser is a a complicated compound consisting of : silica, phosphate of lime, potassium, sodium and free me. It contains 12 per cent of phosphoric acid of which 75-95 per cent soluble in citric acid ; from 3-4 per cent of potassium and 25 per cent of me. The potassium is completely soluble in hydrochloric acid, almost ompletely soluble in water saturated with carbonic acid, while 25 per cent f it is soluble in pure water. In the manurial experiments, about 75 per ent of the potassium was utilised by the plants.

" Rhenaniaphosphat " has the additional advantages of being easily pread, of not being hygroscopic and of mixing easily with other fertilisers.

Its phosphoric acid, moreover, is as available as that of basic slag, which ertiliser the new compound greatly resembles in its effect, while it is lightly more rapid in its action.

" Rhenaniaphosphat " is particularly suitable as a fertiliser for light, cid soils rich in humus, but it also gives good results in the case of heavy oils under leguminous crops.

97 – **Report on Experiments with Bacterised Peat or Humogen.** (1) — CHITTENDEN, F. J. (Contribution from the Wisley Laboratory) in *The Journal of the Royal Horticultural Society*, Vol. XLI, Part 2, pp. 305-326. London, December 1915.

These experiments were begun in 1914 at the request of the Council of the Royal Horticultural Society.

*Nature of the Peat.* — The raw material consists of peat moss litter (or dried sphagnum) with an ash content of only 1.37 per cent. It is brown in colour and acid in reaction, and is generally detrimental to plant growth. The bacterising process consists of three stages : 1) treatment with a culture solution of the special ' humating ' bacteria and incubation at a constant temperature for a week or 10 days ; during this period solu-

(1) See also *B.* 1914, Nos. 410 — 9821 — 102. (*Ed.*)

ble humates are formed ; 2) destruction of the humating bacteria by sterilisation with live steam; 3) treatment of sterilised peat with mixed culture of nitrogen fixing organisms — *Azotobacter chroococcum* and *Bacillus radicicola* — and incubation at 20° C. for a few days, after which it is ready for use. Prof. Bottomley's theory is that the nitrogen fixing bacteria thrive on the soluble humates formed by the humifying bacteria. His analyses showed that the nitrogen content increases from about 1.267 per cent to 4.31 per cent in the finished product.

Four consignments of peat were used and there was a marked difference in appearance between the different lots.

*Object of the Experiments.* — The experiments were designed to determine whether the alleged acceleration of growth was due to : 1) the water holding capacity of the peat, or 2) the salts and especially the nitrogen it contained, or 3) the action of hypothetical accessory food bodies, which may be called activators.

*Experiments in* 1914. — The first experiments were carried out with loam in pots under glass. The plants chosen were *Primula malacoides, Begonia semperflorens, Eupatorium adenophorum* and tomato.

Owing to the great individual variation amongst the primulas they were discarded. The Begonia plants were grown in 5 sets of 4 plants of equal size and age, and different quantities of bacterised peat were compared with ordinary loam and a mixture of loam and raw peat. A considerable difference between the plants was seen in a week or 10 days and this difference became more marked as time passed. The plants in the bacterised peat were all of a much deeper green, had larger leaves, became considerably taller and showed a much greater tendency to branch from the base than the control plants, while the leaves of plants in the soil containing raw peat showed a rendency to burn.

*Eupatorium adenophorum* is particularly suitable for these experiments as it is remarkably uniform in growth and grows quickly at the dull season of the year in an ordinary greenhouse. The luxuriance of growth in the treated peat compost was very marked, the area of the last eight leaves of the plants in the treated peat compost being more than 50 per cent greater than that of the plants in the untreated pots.

*Tomato.* — Twenty seedling tomatoes were grown in large pots with ordinary loam. Another series of twenty were grown in soil containing $^1/_8$ of bacterised peat and a third series to which ordinary peat was added. The plants in the soil containing the bacterised peat were much more luxuriant and had darker foliage. This luxuriant growth however was not accompanied by a delay in the flowering period as would be expected. In fact flowers first appeared on these plants and were borne little higher up the stem than were those on the plants in ordinary soil. Little difference was noticeable between the plants in the ordinary soil series and those in the soil and raw peat series.

In these experiments no obvious effect on the root development was observed as recorded by other experimenters, but in all the plants there was a copious branching of the plants growing in the bacterised peat. Compa-

rison of the growth of plants in soil and bacterised peat with that in soil and untreated peat shows that the water-retaining power of the peat is not sufficient to account for the differences in growth.

Increasing the amounts of the bacterised peat up to one half the content of the pots caused very slight increase in growth and no detrimental effect, thus supporting the theory of the existence of " activators " in the treated peat.

*Experiments with peat extract.* — Tomatoes were grown in sand and watered with the following extracts :

1. water extract of bacterised peat
2. " " of boiled peat
3. " " of untreated peat
4. ammoniacal water extract of untreated peat
5. water alone.

In a each case 12 plants were used. The extract was given once a week and water as required.

The plants receiving the ammoniacal extract all died within two days. None of the plants grew well but those receiving the bacterised peat extract grew leaves twice the size of the others. There was practically no difference between the plants watered with either of the other peat extracts and those watered with tap water.

These results show that the value of treated peat lies in the water soluble constituents after bacterisation and that mere heating does not bring about these changes in the peat.

*Experiments in the open garden.* — The soil of these plots is very sandy, but retains sufficient moisture to keep plants growing. Radishes, turnips and French beans were grown. Three plots were arranged for the crops as follows :

Plot A. bacterised peat at the rate of 2 tons per acre, hoed in.
" B. no peat or other manure.
" C. untreated peat at same rate as A.

In one series, radishes (French Breakfast) were sown on May 20 and the crop removed and weighd on July 9.

No difference was seen in the growth of the plants on the respective plots, nor was there any difference in the rate of germination. The average weights of the plants from plots A and B were the same.

On another series of plots " Early White Stone " turnips were sown on May 25.

Plot A. received no dressing.
" B. received bacterised peat at the rate of 1 ton per acre.
" C. as plot B. with an addition of 150 grs of manganese sulphate.

These plots were arranged in triplicate. The results were summarised as follows :

| Series | Treatment. | | |
|---|---|---|---|
| | Nothing. | Bacterised peat. | Bacterised peat + Manganese |
| | lbs | lbs | lbs |
| 1 | 123·5 | 136 | 134 |
| 2 | 128 | 135 | 118.25 |
| 3 | 75·5 | 77·25 | 90 |

There appeared to be some hastening of growth in the seedling stage by the use of the bacterised peat. In all cases there was a slight increase in the weight of crop due to the bacterised peat. This increase, however, was more in the tops than in the roots where the bacterised peat alone was used. The effect of the manganese appeared to be to redress the balance between root and top which was upset by the bacterised peat. *Dwarf French Beans* were grown on another series of plots and the following results obtained:

| | No. of Plants. | Weight of seed. |
|---|---|---|
| | | grms. |
| Plot A. untreated peat . . . . . | 691 | 2 692 |
| » B. no manure . . . . . | 737 | 2 695 |
| » C. bacterised peat . . . . . | 649 | 2 685 |

The average yield for each plant was in all cases small. That from the plot receiving untreated peat was about 3 per cent above the control while that from the plot receiving the bacterised peat was 12 per cent above the control.

*Grass.* — A grass plot 10 ft × 60 ft was dressed with bacterised peat at the rate of 3 tons per acre, but no visible effect was observed from the dressing.

These results were much inferior to those obtained in the pot experiments. In order to remove the possibility of the soil moisture being the limiting factor, another series of experiments was arranged in open ground artificially watered.

The soil chosen was poor and had not been recently manured. Ten plots were used and turnips were grown under various treatments as follows:

| Plot. | | Treatment. | Average weight per plant in lbs. | | |
|---|---|---|---|---|---|
| | | | Tops. | Roots. | Total. |
| | 1. | Bacterised peat | ·33 | ·64 | ·97 |
| | 2. | Bact. peat and farmyard manure | ·34 | ·67 | 1·01 |
| | 3. | Farmyard manure | ·34 | ·68 | 1·02 |
| | 4. | » » » and artificials | ·4 | ·67 | 1·07 |
| | 5. | No manure | ·28 | ·69 | ·89 |
| | 6. | Lime | ·3 | ·66 | ·96 |
| | 7. | Bact. peat and lime | ·33 | ·7 | 1·03 |
| not watered. | 8. | Bact. peat | ·29 | ·56 | ·89 |
| not watered. | 9. | No manure | ·3 | ·6 | ·9 |
| not watered. | 10. | Farmyard manure | ·29 | ·63 | ·92 |

In both the watered and unwatered plots farmyard manure gave the heaviest plants, and where bacterised peat was used on the watered plots it had a good effect, but not so great as farmyard manure, especially when assisted by artificials. On the unwatered plots the bacterised peat actually diminished the yield. The peat + lime on the watered plots was about equal to the farmyard manure plots.

The greatest average weight of roots was given by the peat in conjunction with lime: next came the no manure followed by farmyard manure. There was less difference between the weights of roots than between the total weights, which points to the fact that the greatest difference was in the foliage. Apparently the watering assisted the action of the peat as well as that of the farmyard manure.

*Experiments in* 1915. — Similar experiments were carried out this year with further consignments of bacterised peat, using radishes both under glass and in the open and turnips in the autumn.

The growth of the radishes was retarded by the peat but the turnips grew much more rapidly at first and appeared taller and greener. Considering the weight of the roots produced, the effect of the peat appeared to be negligible. The failure to obtain a striking increase cannot be attributed to lack of water and the results do not justify the assumption that the peat contained 4.3 per cent of nitrogen as previously stated. A dressing of 1 ½ tons per acre, the amount applied in this year's experiments, would be equivalent to the heavy dressing of 5 cwt. of nitrate of soda per acre assuming only half of the nitrogen to be available. These considerations strengthen the belief that the bacterised peat is of very variable composition.

At the present price of £ 10 per ton the bacterised peat is inferior to farmyard manure, 20 tons of which can be delivered at a cost of £ 8, producing a greater yield than can be obtained by the application of 1 ton of the peat.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS

498 - **Plants Indigenous to Chile which are Cultivated, Capable of Cultiva tion, or Useful.** — Reiche Karl, in *Boletín de la Societad de Fomento Fabril*, year XXXII, Nos. 7, 10 and 11, pp. 474-486, 679-684, 776-784, Santiago, July, October and November 1915.

Attention is first drawn to the fact that the introduction into Chile, immediately after its discovery, of plants cultivated in Spain, prevented the cultivators devoting themselves to the improvement of the native plants which are capable of giving good results when selected and cultivated. A list is given of the most promising plants, each name being followed by a description of the species, its habitat and the manner in which it is used.

The species mentioned are as follows :

I. Cereals and other plants with edible seeds. — Those grown formerly by the natives — "mango" (*Bromus mango*); "quila", or "colihue" (*Chusquea* sp.) — have been completely replaced by maize imported by the Incas, or by European cereals. However "quinoa" (*Chenopodium Quinoa*) (1) is still a somewhat important crop.

II. Tubers and Roots : the best known and most used are : *Oxalis lobata* ("flor de la perdiz") — *Cumingia campanulata* — *Solanum tuberosum* and *S, maglia*, of which the tubers are employed — *Alstroemeria Ligtu* ("liuto") with starch-containing roots.

III. — Fibre crops. The Chilian species of *Linum* are of a low habit of growth ; those belonging to the *Urticaceae* have never been used ; there are therefore no indigenous textile plants properly so-called. On the other hand, there are quantities of lianes with long, flexible, resistant stems which are used as cords in basket-making and are included under the name of "voquis", such as, for example ; *Lardizabala biternata* — *Boquila trifoliata* — *Cissus striata* — *Griselinia racemosa* — *Mitraria coccinea* — *Columnea ovata* — *Luziariaga radicans* and *L. erecta* ("quelineja") — *Marsippospermum grandiflorum*. In the salt marshes of the southern part of Chile, *Schoenodon chilensis* ("Canutillo") is grown. From the stems and leaves of *Juncus procerus* and *Cyperus laetus* and from the leaves of *Greigia sphacelata, Typha angustifolia*, and *Jubaea spectabilis*, mats and baskets are made ; ropes are dressed with the bark of *Aristotelia Macqui*.

IV. — Plants useful for tanning. — Chile possess excellent plants useful for this purpose : *Balsamocarpum brevifolium* ("algarobilla") of which the tannin-containing pods are largely exported — *Persea Lingue* — *Cryptocarpa Peumus* — *Euchryphila cordifolia* — ("muermo" or "ulmo") both with tanniferous bark — *Gunnera Chilensis*, with tanniferous rhizomes.

V. — Plants containing saponin. — Of these the chief is *Quillaja saponaria* which is found from the Province of Coquimbo to Araucania; *Solanum elaeagnifolium* (whose pods contain saponin) is much less important, it is common in the northern provinces, as far as the province of Aconcagua.

VI — Dye Plants. — The pods of the "maqui" impart a brilliant colour to red wines, and are much exported. *Galium Relbun* — *Gunnera*

(1) See also *B.* January 1916, No. 59.

*chilensis* — *Cephalophora* sp. *Flaveria contrayerba* were formerly grown, they furnish red, black and yellow dyes respectively.

VII. — PLANTS CONTAINING GUMS AND RESINS. — *Puya coarctata* and *P. alpestris* produce Chagual gum; — *Tessaria absinthioides* (" brea vegetal ") furnishes a resinous gum; — *Flourensia thirufera* — *Robinsonia Gayana* and *R. thurifera* — *Baccharis rosmarinifolia* — *Laretia acaulis* (" llareta ") furnish resins that can be used for various purposes (the second is a substitute for galbanum resin); — the resins of the Chilian conifers (*Fitzroya* — *Libocedrus* — *Araucaria* etc,) are not yet utilised.

VIII. — MEDICINAL PLANTS. — These are very abundant in the Chilian flora, and many of them are used by the empiric practitioners of the country, but only very few are entered in foreign pharmacopœias; the chief are :

*Used for their leaves : Eugenia Chequen* (" chequen ") — *Boldoa fragrans* — *Lithraea venenosa* — *Glarionea atacamensis* (" marancel ") — *Eritrichium gnaphaloides* (" tè de burro ") — *Gnaphalium viravira* (" viravira ") — *Flaveria Contrayerba* — *Eryngium rostratum* (" caucha ") — *Fabiana imbricata* (" pichi ") — *Psoralea glandulosa* (" culen ") — *Latua venenosa* (" latué ") — *Quinchamalium majus* and other species (" quinchamali ") — *Haplopappus Baylahuen* (" baylahuen ") — *Solanum Berteroanum* and S. tomatillo (" natri ") — *Castrum Parqui* — *Ambrina ambrosioides* — *Artemista copa* (" copa ") — *Senecio crispus* (" chachacoma ") *Oxalis rosea.*

*Used for their bark*: *Psoralea glandulosa* — *Quillaja saponaria* — *Drimys Winteri* (" caneol "). *Used for their roots*: *Valeriana papilla* ("papilla ") — *Argylia huidobriana* (" triaca ") — *Anisomeria drastica* (" pircum ") — *Calystegia rosea* (" caricillo ").

IX — VARIOUS PLANTS — Plants for binding dunes : *Distichlis thalassica* — *Panicum urvilleanum* — *Hierochloa utriculata* — *Isolepis nodosa* — *Carex pumila* subsp. *littorea* — *Mesembryanthemum aequi-laterale* — *Polygonum chilense* (" doca ") — *Fragaria chilensis* (the two last also supply a crop) ; in the northern region, the sands are bound naturally by *Coldenia atacamensis* and by the low growing shrubs, *Skytanthus acutus* and *Ephedra andina.*

*Plants for Quickset Hedges : Greigia sphacaelata* and *Puya coarctata* are used in the northern oases — *Gourliaea decorticans*, low-growing and with interlaced branches — *Rubus ulmifolius* and *Opuntia vulgaris* are two of the hedge plants imported into and acclimatised in Chile.

*Plants furnishing beverages and syrups* — After the introduction into Chile of the vine and the wine-making industry, the old custom of making fruit wines was discontinued. Formerly, the fruits of *Aristotelia Macqui* — *Fragaria chilensis* — *Lithraea molle* (" molle ") and *Ugni Molinae* etc. were used, and even a fungus called " llaullan " (*Cyttaria* sp.). However the manufacture of " chicha " from the drupes of the " molle " is still a fairly important industry. In the palm groves of Ocoa and Cocalan, a syrup sold under the name of " palm honey " is obtained by the concentration of the sap extracted from a topped trunk of *Jubaea spectabilis.* The

chief honey-producing plant is *Eucryphia cordifolia* (" muermo ", or " ulmo "), to which is due the abundance and exquisite flavour of the " valdiviano " honey ; it flowers in January and February.

The Chilian *kitchen-garden plants* are on the whole of little importance, for they have been advantageously replaced by imported and acclimatised species. However, the following are grown : the " berro " (*Cardamine nasturtioides*) — the " pangue " (*Gunnera Chilensis*) and the " tetilla " (*Tetilla hydrocotylifolia*) of which the young petioles (" nalcas ") etc. are used. The best native truck plant is *Tetrakonia expansa* which grows wild on the coastal zone from Coquimbo to Chiloé ; it is exported and cultivated abroad, but not made use of in Chile.

EDIBLE CRYPTOGAMS. — The " huilte " and the " cochayuyo ", or " hierba del mar ", are used by the people as food, the first comes from the stems, the second from the digitate laminae of a large marine alga, *Durvillaea utilis*, growing between Valparaiso and Cape Horn. The fresh or dried laminae of the " luchi " (*Ulva latissima*) are also used as an article of diet. The following fungi are edible : *Agaricus campestris* (found in enormous quantities north of *Punta Arenas*) — *Pholiota edulis* — *Clavaria coralloides* — a species of *Boletus* etc.

X. — FRUIT-BEARING SPECIES. — *Fruit trees : Araucaria imbricata* (" piñal ") of which the seeds are edible — *Podocarpus andina* (" llengue ") — *Jubaea spectabilis* (" palma di Chili "), oil is also extracted from its seeds — *Guevina Avellana* (" avellana ") — *Boldoa fragans* (" boldo ") — *Gomortega nitida* (" queule ") — *Cryptocarya Peumus* (" peumo ") with oleaginous seeds — *Bellota Miersii* (" belloto "); in many parts of the province of Aconcagua where this species is very plentiful, its acorns might be used for fattening pigs — *Persea gratissima*, var. *melanocarpa* (" palta negra ") much cultivated in the valley of Quillota — *Lucuma Valparadisea* (" palo colorado ", or " lucuma silvestre ") common in the narrow, damp, shady valleys of the provinces of Aconcagua and Valparaiso ; at present, the fruit of the wild tree is not eaten, but the species seems capable of improvement by cultivation — *Gourliea decorticans* (" chañar ") — *Prosopis siliquastrum*, and other allied species, (" algarrobos ") of which the fruit is much prized in N. Chile as a feed for domestic animals.

FRUITING SHRUBS. — *Aristotelia Macqui* (" maqui ") ; its fruit its eaten raw, or prepared in different ways ; " chicha ", an alcoholic beverage is made from it, while a colouring matter is extracted from the seeds. *Ugni molinae* (" murtillo "), one of the best native fruits — *Berberis buxifolia ;* cakes and syrups are made from its fruits — *Pernettya* spp. — *Gaultheria* spp. — *Myrteola leucomyrtillus* (" huarapo ") — *Ribes magellanicum* (" parrilla ") whose bunches of black berries well deserve the attention of horticulturists — *Empetrum rubrum* — *Rubus geoides*, and *R. camaropis radicans* (" hiñemiñe ") — *R. ulmifolius* (" zarzamora ") has since become acclimatised in Chile and produces excellent fruit, which however is but little appreciated — *Lardizabala biternata* (of which the fruits are called " cóguiles ") — *Margyricapus setosus* (" sabinella ") — *Muehlenbeckia chilensis* (" quilo ")

— *Ephedra* spp. (" pingopingo ") — *Krameria cistoidea* (" pacul ") its seeds are used as a substitute for coffee.

HERBACEOUS FRUIT BEARING PLANTS: *Fragaria chilensis* (" frutilla ") this is eaten fresh, or dried ; " cicha " is made from it — *Greigia sphacelata* of which the fruits are called " chupones " — *Lapageria rosea* (" Copihue ") — *Mesembryanthemum aequilaterale* (" doca ") with edible, slightly laxative fruit — *Cereus* spp., *Eulychnia* spp., and *Psidium pyriferum* of which the yuicy, somewhat acid fruits all bear the name of " guayaves ".

XI — FOREST TREES (1). The most important species furnishing firewood are : in South Chile ; *Tepula stipularis* (" tepú ") — *Eucryphia* sp. in the province of Santiago : *Quillaja saponaria* (" quillai ") — *Lithraea venenosa* (" litre ") and *L. molle* — *Prosopis siliquastrum* — *Acacia cavenia* (" espino ") — *Maytenus boaria* (" maiten ") — Many other species used for firewood and charcoal are only of local importance.

The northern zone of Chile (from the frontier of Peru to Coquimbo) produces few forest trees : *Prosopis siliquastrum* and *P. tamarugo* (" tamarugo ") — *Gourliea decorticans* — *Polylepis incana* (" queñoa ") — *Schinus molle* (" molle " or " pimentero ") — *Salix Humboldtiana* (" sauce ") — *Cordia decandra* (" carbon ") etc.

The chief forest trees of the central zone of Chile (from Coquimbo to Conception and *Araucania* are : *Quillaja saponaria* — *Criptocarya Peumus* — *Bellota Miersii* — *Persea lingue* and *P. Meyeniana* — *Acacia cavenia* — *Aetoxicon punctatum* — *Lithraea venenosa* and *L. molle* — *Boldoa fragrans* — *Drimys Winteri* (" canelo ") — *Tricuspidaria dependens* (" patagua ") — *Maytenus boaria* — *Villarezzia mucronata* (" huilli-patagua ") — further south : *Gomortega nitida* — *Nothofagus obliqua* (" roble ") ; *N. Dombeyi* (" coigne "); *N. procera* (" rauli ") — *Myrceugenia apiculata* (" arrayan ") and *M. Pitra* (" pitra ") — *Myrtus luma* — *Libocedrus chilensis* (" cipres ") — *Araucaria imbricata* (" araucaria ").

The southern zone of Chile is rich in forest, composed, not only of the numerous trees that it possesses in common with the central zone, but also of others that are peculiar to it, such as : *Eucryphia cordifolia* — *Laurelia aromatica* (" laurel ") and *L. serrata* (" huahuan " or " vauvan ") — *Nothofagus pumilio* and *N. antarctica* (" ñirre ") — *Edwardsia masnahiana* (" pelú ") — *Maytenus magellanica* (" leña dura ") — *Tepualia stipularis* — *Weinmannia trichosperma* (" teñiu ") — *Guevina avellana* — *Embothrium coccineum* (" notru ") — *Libocedrus tetragona* (" cipres del sur ") — *Fitzroya patagonica* (" alerce ") — *Saxegothaea conspicua* — *Podocarpus chilina* (" mañiu ") etc.

499 - **Colonial Plants of Economic Importance Cultivated in the Royal Colonial Gardens of Palermo, and Capable of Acclimatisation in Sicily.** — TROPEA G., in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. I, Part 3, pp. 149-158 ; Vol. II, Part I, pp. 36-41 ; Part 4, pp. 231-234. Palermo, 1915-1916.

The botanical name of each plant is given, followed by information as to its economic utility, its characters and appearance, observations upon

(1) See in *B.* December 1914 pp. 1535-1541. Original Article by Federico Albert : « The Forests of Chile ». (*Ed.*).

its behaviour in the Colonial Gardens of Palermo, and opinions regarding the possible economic importance of its acclimatisation to Sicily.

Amongst the most important species that have proved capable of growing in the open in the above-mentioned gardens may be mentioned: *Ficus elastica* (the rubber obtained from it has been valued at 10 fr. per kg. (6 s. per lb); *F. religiosa, F. indica, F. Vogeli* — *Manihot Glaziovii* — *Achras sapota* — *Aegle sepiaria* — *Agave rigida* var. *sisalana* (suitable for cultivation in Sicily on 'plains and slopes facing south. — *Anona Cherimolia* (alreay perfectly acclimatised in Calabria) — *Arachis hypogaea* — many species of *Bambusaceae* — *Cecropia palmata* — *Cheirostemon platanoides* — *Chloris Gayana* (acclimatised in Sicily; this plant has resisted drought and produced an excellent crop of forage, even without irrigation) — *Colocasia esculenta* — *Cordia Sebestena* — *Diospyros Kaki* — *Mangifera indica* (suffers a little during the winter) — *Persea gratissima* (its fruits ripen completely) — *Pilocarpus pinnatifolius* (which, however, produces little pilocarpine) — *Psidium Guayava* — *Saccharum officinarum* (produces a little sugar; it would, however, be best to grow it only for forage) — *Sapindus Mukorossi* — *Sechium edule.* In Sicily, the latter remains in a herbaceous condition, it only ripens in the autumn; it bears about a hundred fruits per plant (hence its name of "Zucca centenaria" by which it is commonly known in the island). Its young tops are used as a vegetable, while its fruits (when cooked) and its root tubers (after the 2nd year) are also used for human consumption. The writer draws attention to the importance that this plant possesses for Sicily when the soil conditions are favourable to its cultivation.

500 – **The Distribution of the Genus *Lotus* in European Russia and the Caucasus.** — GROMOW J. in *Troudy Bureau po prikladnoi botanikie* (*Bulletin of Applied Botany*), Year VIII, pp. 1025-1057. Petrograd, September 1915.

A systematic review of the species and varieties of the genus *Lotus* in European Russia and the Caucasus, together with maps of the distribution of each variety. Much use is made of the literature referring to the subject, and given in a bibliography at the end of the article.

The genus *Lotus*, which does not occur in America, is found all over the eastern hemisphere, reaching 71° N. latitude. On the west coast of Africa, it is found at 10° on the east coast, at latitude; 30° south and though absent in the south east of Asia, it appears in Australia.

Nearly all the species are especially common on the sea coast, whether the latter be sandy, argillaceous, rocky or grassy, dry or marshy. Some species of *Lotus* grow equally well on low plains, and on high ground, where they can be found at an altitude of 415 metres.

Of the 60 species of *Lotus*, distributed for the most part in the mediterranean region, only 7 occur in Russia, and these belong, almost exclusively to the *Antholotus* section; 3 of these species; *Lotus Gebelia* — *L. lamprocarpus* — and *L. strictus* are only found in districts of the Caucasus; *L. ornithopodioides* grows., not only in the Caucasus, but also on the sea coast of southern Russia in Europe; while *L. uliginosus* occurs only on the western portion, *L. augustissimus* in the south-eastern part of Russia in Europe,

and *L. corniculatus*, in many different forms, is the only species that occurs throughout the whole of Russia.

501 - **The Inoculation of the Chief Leguminosae with Six Different Species of Nodule-forming Bacteria. Experiments Carried Out in Kentucky, U. S. A.** — GARMAN H. and DIDTAKE MARY in *Kentucky Agricultural Experiment Station Bulletin* No. 184, pp. 343-363 + 7 Plates, Lexington, Ky. August 1914.

A report on experiments in inoculating the most commonly cultivated leguminosae with different species of nodule-forming bacteria. The writers used some thousands of plants, growing them for the most part on solutions of agar in test tubes and bottles ; they carefully sterilised both the nutritive solution and the receptacles, taking all possible precautions to avoid contamination. The following are the results of the experiments.

The statement that the organism causing nodules on the roots of Lucerne (*Medicago sativa*) is the same as that producing nodules on *Melilotus alba*, has been proved to be wholly correct. Cultures of the organism from the nodules on the roots of lucerne cause nodules on the roots of *Melilotus alba*, as well as on those of the lucerne itself, and *vice-versa*. Further, this bacterium has proved itself to be identical with that producing nodules on 2 other related species viz : *Medicago lupulina* and *Medicago denticulata*. Therefore, cultures of the bacteria from these 4 different species of plant can be used equally well for the inoculation of one any of them. But these bacteria do not produce nodules on the roots of any species of *Trifolium* — *Vicia Pisum* — *Vigna* — *Glycine* — *Phaseolus*.

All the species of *Trifolium* are affected by a single species causing the nodules. The culture will produce nodules on the roots of any other member of the genus, no matter from what species of Trifolium the organism is obtained ; it will not do so in the case of plants of the genera: *Medicago* — — *Melilotus* — *Pisum* — *Vicia* — *Vigna* — *Phaseolus* — *Glycine*.

The microrganism producing nodules on the vetch and garden pea, appears to be distinct in physiological character from the two preceding. Cultures from the nodules of *Vicia villosa* do not produce nodules on : clovers ; lucerne ; *Vigna Catjang*, soya beans and common beans ; nor do the organisms from these nodules give rise to nodules on *Vicia hirsuta*, they can, however, be transferred to the roots of *Vicia sativa;* in the same way, cultures of bacteria from pea nodules produce nodules on *Vicia sativa*. Cultures of the bacteria from the nodules of the spring vetch and the garden pea show similarity when examined under the microscope, which supports the belief that the micro-organisms are identical.

Nodules could not be produced on the roots of any other species of leguminosae by means of cultures from the nodules of *Vigna Catjang*, nor in the cow-pea by inoculating the roots of the latter with cultures taken from the nodules of any other leguminosae. It therefore seems that the bacteria giving rise to nodules on *Vigna Catjang* must constitute distinct species.

The same result having been obtained with the bacteria from the nodules of the soy bean and the garden bean, these two micro-organisms must be regarded as two distinct species of nodule bacteria.

The chief conclusions drawn from these results are as follows : the bac-

teria producing nodules on the roots of the commonly grown leguminou plants are of different species, differing from one another in their physic logical behaviour. A given species of bacterium may be confined to a singl species of Leguminosae, or be common to several species of this family and these several species may not be members of one genus, though the commonly are.

An organism which does not naturally produce nodules on a certai plant, cannot be induced to adapt itself to this new host. Thus, the vetc bacteria after being cultivated for a year on a medium made from an infu sion of the roots of soy bean, would not produce nodules on the soy bea at the end of this time while still producing them abundantly on their ow host plant, the vetch.

In the earlier experiments, little difference was found in the plants in favour of the inoculated lots ; in fact, the controls frequently started off rather better than the treated individuals, but the plants with good nodules persisted longer, and showed more vigour in resisting decay, often retaining their leaves longer than the controls.

Details are given of a somewhat large number of inoculation experiments.

502 - **The Presence of Copper in Tomatoes and Tomato-Preserves.** — LIBERI G., CUSMANO A., MARSIGLIA T., ZAY C., in *Annali della R. Stazione chimico-agraria sperimentale di Roma*, Series II, Vol. VIII, pp. 163-303, Rome, 1916.

This paper is divided into 2 parts :

I. *Historical*, consisting of the following chapters : 1) Copper in plant and animal organisms — 2) The physiological action of copper: *a*) on plant organisms ; *b*) on animal organisms — 3) copper from the legal standpoint — 4) Review of the methods for determining small amounts of copper in animal and plant substances.

II. *Experimental*, consisting of the following chapters : 1) Method followed for estimating copper — 2) Experiments on tomatoes in the experimental field of the Station of Agricultural Chemistry in Rome — 3) Presence of Copper in tomatoes grown in Italy, in preserves made of these tomatoes and on land devoted to this crop. — 4) Conclusions.

The electrolytic method was employed for estimating the copper, and as it was always a question of very small quantities, the weighing of the copper was followed by a colorimetric test.

In the Grottarossa experimental station belonging to the Station of Agricultural Chemistry of Rome, tomatoes are grown with a view to ascertaining whether it is possible to detect and estimate in the different parts of the plant and fruit, the copper derived, either from the normal quantity present in the soil, or from sprayings with Bordeaux mixtures. The following tables give some of the principal results obtained.

TABLE I. — *Composition of the Tomato Fruit.*

A. — *Approximate Composition.*

| | In 100 parts of fruit | | |
|---|---|---|---|
| | fresh | dry at 110° C. | ash |
| | — | — | — |
| The juice and pulp correspond to . . . | 98.75 % | 79.67 % | 95.00 % |
| The seeds " " . . . | 0.76 | 12.36 | 3.45 |
| The skins " " . . . | 0.49 | 7.97 | 1.55 |

B. — *Composition of the various parts of the fruits.*

| | Water and volatile matter at 110° C. (by difference) | Non-volatile residue at 110° C. | Ash |
|---|---|---|---|
| | — | — | — |
| Juice . . . . . | 95.91 % | 4.09 % | 0.60 % |
| Pulp . . . . . | 89.61 | 10.39 | 1.02 |
| Seeds dried at 110°C. . . . . | — | 100.00 | 3.11 |
| Skins dried at 110°C. . . . . | — | 100.00 | 2.11 |

TABLE II. — *Copper contained in the different parts of the tomato fruit and in the soil (in mg.).*

| Bordeaux mixture sprayings | Copper in 1 kg. of juice and pulp | | | Copper in 1 kg. of seeds | | Copper in 1 kg. of skins | | Copper in 1 kg. of dry soil |
|---|---|---|---|---|---|---|---|---|
| | Fresh | Dried at 110° C. | Ash | Dried at 110° C. | Ash | Dried at 110° C. | Ash | |
| None . . . . . | 0.25 | 5.04 | 37.99 | 10.45 | 336.03 | 7.91 | 364.52 | 7.20 |
| 1-5 sprayings of plants. | 0.35 | 7.09 | 53.48 | 9.87 | 317.23 | 8.86 | 408.48 | 7.19 |
| 1 spraying of soil . . . | 0.46 | 9.27 | 69.90 | 11.72 | 376.85 | 12.46 | 574.20 | 16.20 |

TABLE III. — *Distribution of 100 parts of copper in the different parts of the tomato fruit.*

| Treatment | In the pulp and juice | In the seeds | In the skins |
|---|---|---|---|
| | — | — | — |
| No spraying. . . . . | 67.67 % | 21.64 % | 10.69 % |
| 1-5 sprayings of plants . . . . . | 74.68 | 16.09 | 9.63 |
| 1 spraying of soil. . . . . | 75.17 | 14.73 | 10.10 |

TABLE IV. — *Distribution of the copper in the different parts of the tomato plant *, mg. of copper per kilogram of matter dried at 110° C.*

| | | | |
|---|---|---|---|
| Roots . . . . . | 8.44 mg. | Clusters . . . . . | 6.42 mg |
| Stems . . . . . | 6.45 " | Whole fruits . . . . . | 7.43 " |
| Leaves . . . . . | 7.83 " | Soil . . . . . | 7.37 " |

* The plants had been sprayed twice with lime-sulphur mixture.

TABLE V. — *Copper contained in the different kinds of preserves made of tomatoes from the experimental field* (in mg.)

| Treatment | In 1 kg. of unconcentrated juice and pulp | In 1 kg. of preserve where the juice and pulp were reduced to | | | | |
|---|---|---|---|---|---|---|
| | | 40% | 25% | 20% | 15% | 10% |
| No spraying | 0.25 | 0.63 | 1.00 | 1.25 | 1.67 | 2.50 |
| 1-5 sprayings of plants | 0.35 | 0.88 | 1.40 | 1.75 | 2.33 | 3.50 |
| 1 spraying of soil | 0.46 | 1.15 | 1.84 | 2.30 | 3.07 | 4.60 |

In the various centres of tomato growing, and especially in the most important ones, 84 samples of the fruits were taken, each accompanied by a sample of the soil on which the fruit had been grown, and by all the data relating to it. It was especially important to know whether the plants had been treated with copper, and if so, how often.

The copper was estimated : 1) in the juice and pulp of washed tomatoes ; 2) in the soil that had produced each sample of tomatoes ; 3) often also in the residue (seeds and skins), and in the water used for washing. The results are given in numerous tables. Further, the importance of tomato cultivation is dealt with and of the preserve industry in the case of each region of Italy, while statistical data, lists of factories, etc, are given

*Conclusions.* — The examination of numerous samples of tomatoes, and of soil taken, either from the writer's experimental ground, or from different districts of Italy, proved that :

1) In the fruits of the tomato, copper is constantly found, without any exception, in quantities varying from 0.14 mg. to 2.10 mg. per kg. of juice and pulp, and from 3.88 mg. to 19.45 mg. per kg. of dry residue.

2) All the soils upon which the tomatoes investigated had been grown, contained copper up to 110.74 mg. per kg. of dry soil.

3) Spraying the plants with cupric mixtures has no effect upon the copper content of the tomato fruits.

Thus, the presence in the preserves of small quantities of copper is perfectly justified. It must certainly be attributed to the constant presence of this metal in the soil, whence the plant assimilated it in different proportions according to the varying absorbent property shown by soils in respect of copper compounds, and their power of retaining the latter in insoluble forms, or in those assimilated by plants with difficulty.

In the appendix, a bibliography is given of 165 publications.

503 - **The Part Played by Mineral Elements in Plant Life.** — EGOROW M. A., in *Journal Opitnoj Agronomii* (Review of Experimental Agriculture), Vol. XVI, Part 4, pp. 270-279. Petrograd, 1915.

Maturation in *Gramineae* shows in the gradual assumption of a yellow colour, while plants which for some reason or other cannot ripen and form seed, retain their ordinary green colour. In this connection, litt-

le is yet known as regards the part played by the mineral elements in the life of plants.

In attempting to explain this process, the hypotheses of different writers, as to the causes of the death of plants are reviewed. The fact established by BATALINE is quoted, that when after the rye harvest, rain falls followed by a long period of drought, the rye plants can become perennial, and a working hypothesis is suggested.

As the seeds develop, a considerable part of the substance of the plant including the mineral elements, becomes concentrated in the seeds. An element which accumulates in the largest quantities, with the exception of phosphorus and sulphur, is magnesium (up to 50 per cent).

Now, since according to WILLSTÄTTER, magnesium alone of all the mineral elements of the plant is present in the chlorophyll, it is thus concluded that the migration and fixation of this element in the seeds must cause the disintegration of a considerable part of the chlorophyll, or in any case, the absence of the primary material necessary for its regeneration, thus giving rise to the yellow coloration of the plant.

This hypothesis is based upon the data given by Mr R. ARDENT regarding the composition of the different parts of the oat plant during various periods of its life. On calculating the amounts of magnesium, calcium and potassium present, it was found that in proportion as the oat plant developed, a continually increasing quantity of oxide of magnesium became concentrated in the panicles. This amount reached the maximum of 46.38 per cent of the total quantity of oxide in the plant, and its concentration took place at the expense of the leaves and the haulms, which gradually became poor in magnesium.

Further experiments made with wild clover have given positive results ; in order to control them, experiments in emasculating oat plants. were instituted at the Moscow Agricultural Institute. The result of these experiments was, that at the time of harvesting on August 1, the greater number of the emasculated plants were still green, while the control plants were already ripe. On determining the relative amounts of ash, phosphorus and sodium in the emasculated and non-emasculated oat plants, a considerable difference between the former and the latter was found ; from this fact the following conclusion is drawn.

Accepting WILLSTÄTTER'S suggestion, it may be said that annual plants do not persist through a second season, because, after the harvest, their nutritive conditions, in the widest sense of the words, are not such as to permit of a resumption of life activity and especially because, as the plants mature, no migration has been observed of the important mineral — magnesium — from the grain towards the other parts of the plant. Thus if suitable conditions could be obtained for the plant, such as sufficient humidity, heat, and the mineral salts necessary for its nutrition, the plant would regain its activity and if it did not become at once a perennial, it would at all events yield a second cut.

The writer proposes to continue his experiments on the part played

by magnesium in the maturation process of plants, and intends to begin others on the rôles of phosphorus and potassium.

504 – **The Action of Superphosphates on the Root System of Plants.** — SASANOW W. (Work of the Agricultural Experiment Station at Soumy, Russia, in 1915), in *Selskoie Khosiaistwo i Liesowodstwo* (Agriculture and Sylviculture) year LXXV, Vol. CCXLIX, pp. 395-398. Petrograd, November 1915.

This article refers to the experiments begun in 1912 by the Soumy Agricultural Experiment Station in order to study the effect of superphosphates upon the development of the root system of sugar beets. The results of these experiments were as follows :

1) The soluble phosphoric acid of the fertiliser, when applied to the black soils, is fixed by the stratum of soil on which it has been deposited, so that no considerable movement of the phosphoric acid from one layer to another of the soil is observed.

2) The superphosphate applied to the soil greatly contributes to the formation of the very fine network of the roots of the beets, and the largest development of this root system is seen precisely in the layers to which the superphosphates have been applied.

3) Superphosphate has not been found to exert any more specific effect than nitrate and sulphate of potassium upon the root systems of spring wheat, autumn rye, or autumn wheat.

Having once definitely proved that superphosphates have a specific effect upon the root system of beets, the Station studied, in 1915, the action of superphosphates upon the root systems of the following plants : beets ; rye and autumn wheat ; spring wheat ; oats ; millet and maize. The plants were grown in Rotmistrow boxes of the following dimensions . 54 × 5 cms × 54 cms high and containing each 16-17 kgs. of soil per box.

The general conclusions were as follows :

1) Of the plants which were the subject of the experiment, only the beets, and to some extent the millet, developed a very fine network of roots owing to the action of the superphosphates.

2) Nitrate and sulphate of potassium do not promote a greater development of the root system of beet roots.

505 – **Studies of the Formation and Translocation of Carbohydrates in Plants.** — DAVIS, W. A., DAISH A. J. and SAWYER, G. C. (Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. VII, Part. 3, pp. 255-384. Cambridge, February 1916.

The object of these investigations was to throw light on the problem as to how carbohydrates are formed in the foliage leaves of plants, how they are transferred to the reservoirs where they are stored and how they are finally broken down and utilised in subsequent growth.

### I. — THE CARBOHYDRATES OF THE MANGOLD LEAF.

Previous theories concerning the formation of carbohydrates in the leaf may be divided into two classes : 1) those favouring the view that saccharose is the first sugar formed in photosynthesis : 2) those in which the hex

oses are regarded as primary products, saccharose or starch being formed later by synthesis either in the leaf or root.

Much of the previous work on this subject is of doubtful value on account of the insufficient care taken to ensure that no change in the carbohydrates should occur after the picking of the leaves and during the preparation of the sample for analysis. To overcome this requires the instantaneous destruction of the enzymes, which was effected by the writers as follows: Freshly picked leaf material (about 1 kilogram) was dropped in small quantities at a time into a large volume (2 litres) of boiling alcohol to which 1 per by volume (20 cc) of 0.880 ammonia was added so as to neutralise the acids present in the leaf. (If the solution does not remain alkaline more ammonia should be added). The destruction of the enzymes is facilitated by the ammonia which diffuses rapidly into the tissues. Further, the methods of estimating the carbohydrates were revised. Thus the enzyme of *Aspergillus oryzae* or taka-diastase was used in the estimation of starch, since the starch is only converted into a mixture of maltose and dextrose and there is no loss of dextrin. The cane sugar estimations were checked by inversion with invertase (autolysed yeast). Maltose was estimated by the use of maltase-free yeasts, such as *Saccharomyces marxianus* and *S. exiguus*, duplicate fermentations being carried out with ordinary baker's or distiller's yeast. Pentoses were estimated by distilling with hydrochloric acid and weighing the furfurol produced as phloroglucide according to the Knöber-Tollens method.

The polarimetric measurements were made at a constant temperature of 20° C by means of a thermostat.

The results obtained for the increase of the ratio of hexose to saccharose in passing successively from the leaf to mid-ribs and stalks suggest unmistakably that the cane sugar is formed in the leaf and undergoes a regular and increasing amount of inversion as it passes downwards to the root. Thus in leaves picked in September (4 p. m) there was 1 ½ times as much hexose sugar as saccharose in the leaf, whilst the mid-ribs contained 3 ¾ and the stalks 5 times as much reducing sugar as cane sugar. The inversion of the sugar in the mid-ribs and stalks is so rapid that practically the whole of the sugar in the sap of the roots is in the form of reducing sugar. This inversion of the cane sugar from the leaves is probably effected by the invertase shown to be present in the sieve tubes, but absent from the roots. (ROBERTISON, IRVINE and DOBSON, 1909, Biochem. Journal, IV, 258).

During the early stages of growth when leaf formation is the principal function of the plant and the roots are merely small tap-roots, the cane sugar is found to be in large excess of the hexose. Also, the proportions of dextrose and laevulose in the mixture of reducing sugar in the sap is always approximately that of the products of the inversion of cane sugar. The writers consider these facts to outweigh all other arguments hitherto advanced to show that dextrose and laevulose are precursors of the cane sugar in the leaf. Even in plants like the potato, where starch is the reserve substance, and in the grape,, where dextrose is stored, they find that when special precaution is taken in sampling to prevent the action of the leaf enzy-

mes, saccharose is the principal sugar of the leaf. The same is also true of the snowdrop, which stores starch and inulin.

One of the most striking features of the sap of the stalks and mid-ribs is that the proportion of saccharose remains practically constant, whilst the hexoses fluctuate between wide limits. This points to the relatively rapid movement and formation of hexoses. If the sugars travel by simple diffusion, the rate of diffusion of the reducing sugars would be four times that of the came sugar. Further, if cane sugar were free to wander through the tissues, diffusion would take place from the root (the place of high concentration) to the stalks and leaves. It is therefore more probable that the cane sugar of the leaves is translocated entirely as hexose, and that there exists some mechanism in the roots preventing the cane sugar from diffusing out. GUTZEIT (1911) showed that the protoplasm of the cell walls of the beet root was impermeable to cane sugar and that the death of the protoplasm is necessary before the sugar can be extracted.

As regards the mechanism by which saccharose is synthesised from the hexoses, it is improbable that this change is effected by invertase by a process of reversible zymo-hydrolysis since invertase is entirely absent from the root.

## II. — THE DEXTROSE-LAEVULOSE RATIO IN THE MANGOLD.

In the extracts of mangold leaves and stalks, optically active impurities are always present which are not precipitated by basic lead acetate and hence vitiate the estimation of the dextrose and laevulose. These substances are possibly acid amides (such as glutamine and asparagine) or amino-acids (such as glutamic and aspartic acids) which form soluble lead salts. These impurities occur in the leaves, but are much more abundant in the mid-ribs and stalks.

The " apparent dextrose " (D.) and the " apparent laevulose " (L.) were determined as percentages of the total matter dried in vacuo.

In the leaves the dextrose and laevulose appear to be present in approximately equal amount as would be expected if they were formed from saccharose by inversion. When the ratio D : L departs from unity it is probably owing to the presence of a dextro-rotatory inpurity (glutamine?) which increases the amount of dextrose apparently present, but at certain times of the day a laevo-rotatory inpurity seems to predominate so that the ratio $\frac{D}{L}$ becomes less than unity.

In the mid-ribs and stalks, especially at the bottoms of the latter, the dextrose always appears to be in very large excess as compared with the laevulose ; this is probably due to the poportion of the dextro-rotary impurity being relatively greater in these parts than in the leaf, as is shown by the divergences between the polarisation and reduction values of saccharose being far greater.

The fluctuations of the apparent dextrose and apparent laevulose take place more or less regularly during the 24 hours, thus pointing to a regular variation in the optically active impurities.

Until more reliable results can be obtained for the true dextrose and laevulose by methods which are independent of the polarimetric data, it seems justifiable, from the results obtained, to assume that the dextrose and laevulose exist in the leaves and stalks as invert sugar and travel in nearly if not exactly equal proportions to the root, where transformation into saccharose occurs. This assumption agrees best with the regular rise and fall of the total hexoses in the stalks and mid-ribs along almost straight lines during the night, as contrasted with the more irregular fluctuation of the apparent dextrose and laevulose taken separately.

Any conclusions as to whether either of these two hexose sugars is better adapted than the other to tissue formation or to respirat on are valueless because analytical methods at present existing do not give true values for these sugars.

### III. The carbohydrates of the leaf and leaf-stalks of the potato and the mechanism of the degradation of starch in the leaf.

The variation of the carbohydrates in the potato leaf was studied throughout a complete 24 hours' period and the results obtained are summarised as follows:

In the potato leaf when the tubers are beginning to develop, the principal sugar present is saccharose: its amount increases from sunrise up to 2 p. m., following approximately the curve of temperature. It then falls during the rest of the day and night, the rise and fall being both linear. Hexoses are present in the leaf in very small amounts, generally less than 1 per cent of the total dry weight of the leaf. They fluctuate considerably during the early part of the day, the fluctuations being apparently determined by conversion into or formation from starch.

During the early part of the day up to 2 p. m. the proportion of starch changes very little, the small fluctuations which occur being related to changes in the starch which is apparently formed from the hexoses. Directly the amount of saccharose has reached its maximum at 2 p. m. the hexoses begin to increase in the leaf owing apparently to hydrolysis of the saccharose to invert sugar; at the same time "soluble starch" (or dextrin) is first detected in the leaf and its amount increases regularly up to 6 p. m. At 6 p. m., 2 hours before sunset the true starch in the leaf reaches a maximum value, far greater than any previous value during the day. The starch and "soluble starch" subsequently fall rapidly until between midnight and 2 a. m. the amount left is exceedingly small (0.2 per cent) The starch is apparently converted directly into hexose (dextrose), the amount of which increases in the leaf.

In the stalks, reducing sugars predominate greatly over the saccharose, in spite of the fact that in the leaf the latter is in excess. As in the mangold, it is probable that cane sugar is the first sugar formed in the leaf and that it is hydrolysed by invertase in the venous mid-ribs and stalks for the purpose of translocation. Also, as in the mangold the presence of soluble, optically-active impurities vitiate the polarimetric data in estimating

the true proportions of dextrose and laevulose and the amount of saccharose. The fluctuation in the "apparent dextrose" and "apparent laevulose" in the leaf are due to the fluctuations in these impurities.

In the stalks, the amount of optically active impurity appears to be less than in the leaves so that the dextrose is actually in excess as it appears to be, thus indicating that the starch in the tuber is built up from this sugar. This is according to expectation, since starch becomes dextrose exclusively when hydrolysed by either acids or taka-diastase.

Maltose is invariably absent from the potato leaf, and also from the leaves of other plants which form much starch in the leaf. The degradation of starch in the leaves is therefore probably effected by a mixture of enzymes similar to the enzymes of taka-diastase.

PLANT BREEDING

506 – **Potato Selection by Means of Sexual and Asexual Reproduction.** — STUART WILLIAM, in *United States Department of Agriculture, Bulletin* No. 95, 35 pp. + 16 Plates, Washington, May 20, 1915.

The writer first sets forth the importance of potato growing in the United States, and the possibility of its further development. He then draws attention to the distinction that must be made between potato-breeding (here employed in the sense of sexual reproduction) and potato selection, or the isolation and asexual propagation of desirable strains and types. Mr Stuart then gives a brief historical review of previous attempts made in the United States for the improvement of varieties of potato by means of sexual reproduction. He mentions the epoch-making work of GOODRICH of Utica N. Y. (1857), who furnished the type "Garnet Chili", a variety from which was produced "Early Rose" now a type of world-wide reputation. Other less important workers in this field may be mentioned; C. G. Pringle (of Charlotte Vt), E. S. Brownell (of Essex Centre, Ut.) and later, Alfred Reese, Luther Burbank and E. L. Coy.

After giving a detailed description of the structure of the pistil and stamens of the potato flower and the technique of artificial pollination, the writer describes the results he obtained from a series of crosses made in 1909 and 1910 and gives the parentage, number of flowers crossed, number of seed balls developed, percentage of success, and the number of seedlings that produced tubers. The chief conclusions drawn from these results are as follows:

1) The almost total failure of our present day commercial varieties to produce seed balls is due to male sterility rather than to imperfect pistils, or ovaries.

2) The number of ovaries developed in the flowers is smaller in the case of some varieties than in that of others.

3) The commonly accepted theory regarding the inadvisability of allowing more than one or two seed balls to develop on a cyme is not substantiated in 3 crosses which developed 5 and 6 seed balls each.

4) The Up-to-Date class of plants are, as a rule, poor seed-bearers and may be considered as belonging to the male-sterility group, therefore they cannot successfully be employed as pollen-plants.

5) Certain types or strains of a given class of plant possess greater

sexual affinity for each other and are more easily crossed than other strains or types, which are apparently as closely related.

6) The results of the crosses made by the writer do not justify Salaman's assertion that white is not a recessive character.

In the 2nd part of his paper, the writer treats of the asexual selection of the potato. He gives a short historical summary of the work carried out in this direction and then discusses the results obtained from his own experiments in the 2 methods of selection : 1) the tuber-unit method, which consists in planting select tubers having the desired qualities ; 2) hill selection, where plants possessing particular characters are chosen. These results show that prudence should be exercised in advising asexual selection as a means of increasing the yield and improving the quality of the variety. The highest degree of success can only be attained by working with rather large numbers of the plants or tubers selected for reproduction. The tuber-unit and hill-selection methods are chiefly valuable in pointing out the weak, unproductive, and diseased seed tubers, rather than in producing the rapid and infallible increase of the crop.

507 - **The Improvement of the "Washington Navel" Orange by means of Bud Selection** (1). — SHAMEL, A. D. (Bureau of Plant Industry, U. S. Department of Agriculture, in *The Journal of Heredity*, Vol. VII, No. 2, pp. 82-87, 1 fig. Washington, February 1916.

The results obtained from : 6 years of experiment ; the observation of individual trees in plots of 100 trees ; the study of individual tree-performance record data secured by several orange growers.

These results have shown clearly that in the Washington Navel Orange variety we have a number of different types, many of which are undesirable and worthless. The younger groves, namely those that are farthest removed from the parent trees, show the largest proportion of these inferior types. The reason of this deterioration is to be found in the fact that of the 11 common types of the navel orange in California, the most undesirable ones from the standpoint of fruit production are those showing the greatest vigour of growth. The trees of this type throw unusually large numbers of suckers, which have, until recently, been highly prized for budwood. These undesirable trees have thus supplied a much larger proportion of the budwood than the more productive trees with less vigorous growth. It is difficult to secure large supplies of non-bearing bud-wood from the best trees, particularly the sucker growth, for such trees usually produce but little sucker wood. This difficulty is overcome by using fruit wood for propagation, for good trees produce more than poor ones.

It was found that in some of the best navel orange groves in South California, about 25 per cent of the trees are unproductive, or bear fruit of inferior quality ; in some plantations there are even 70 per cent of such trees.

In order to propagate the most productive and valuable type of Washington navel orange, it is necessary to practise bud selection, which consists in securing buds only from those trees that have satisfactory per-

(1) See also B. January 1916, No. 87.

formance records as regards the regularity, abundance, and quality of their crop. This can only be done by keeping individual tree records, which includes the numbering of every tree in the orchard, and the registration of the quality and quantity of the produce of each tree throughout a series of years. By this means, it is possible to know which are the less productive trees in the orchard and to locate the branches bearing little or no fruit, so that these trees may be replaced by the best types, usually by top-working entire trees with carefully selected buds, or by the removal of undesirable limb sports by pruning. Uniform orchards can thus be obtained, that is to say, those with a larger yield, and in which the picking, sorting and handling of the crop is much simplified.

The writer has adopted the practice of cutting for bud wood only that growth which bears typical fruits. His large experience, and that of his collaborators, one of whom budded over 13 000 orange seedlings in 1914, has shown that even if the budsticks are of small diameter, their buds grow as well as the " fat " sucker buds. It is absolutely certain from the observations of the writer, that the buds from fruit wood secured from heavy bearing type trees produce trees with a much larger crop and with considerably earlier bearing habits than those propagated from sucker wood.

The writer recommends that the bud should be inserted, if possible, as soon as it is cut. Spring budding, as a rule, gives the best results.

Bud selection improves the crops of all arborescent plants in the same way as seed selection permits of the improvement of herbaceous plants. By recording the performance of the progeny of select parent trees and noting whether sports, or off-type fruits, occur in the crop, it will be possible to base selection upon pedigree, instead of upon the performances of a single individual, and therefore the results obtained will be much more certain.

508 – **A Fruit of *Juglans regia* Containing a Kernel of *Corylus Avellana*.** — DANIEL L., in *Revue Générale de Botanique*, Vol. XVIII, No. 325, pp. 11-14, Paris, January 15, 1916.

The writer has examined a walnut showing a very peculiar anomaly; its kernel was replaced by a hazel-nut kernel united to a peduncle by a long filament just as in the hazel-nut. The origin of the specimen permitted of no doubts as to its authenticity; it came from a cultivated walnut tree whose branches interlaced with those of a neighbouring hazel. The shell although abnormal, of conical form and entire, was not very remarkable, for such external anomalies occur fairly frequently, and even impress habitual specific characters upon the embryo.

This extraordinary seed was planted with a view to studying its germination, and the type of plant which it might produce. The cotyledons were unequal in size, the larger one being bent back over the smaller, thus preventing the radicle from emerging freely, which only became possible

(1) Cf.: Jean Daniel, Hérédité des xénies chez certaines races de haricots, in *Revue horticole*, June 1, 1914. (*Ed.*).

after the removal of the cotyledons; the leaves stem and root were exactly similar to these of the walnut. Unfortunately, these observations could not be continued, as the seedling perished through the carelessness of the gardener.

In order to explain these singular facts, the writer refuses to admit the hypothesis of a *monstrosity* producing a hazel-nut in the place of a walnut. The only suggestion which appears to him plausible is that of a natural cross between the walnut and the hazel. Although the date of the maturity of the sexual organs differs in the two species, still the hazel pollen might retain its vitality for a certain time, and the period of the formation of the catkins is fairly long. Thus, it is not, *a priori*, an impossibility that the hazel pollen should have fallen on the female inflorescence of the walnut, and remained there alive, until the moment of the maturation of the stigma, when it would fertilise the ovum.

The writer suggests fertilising the walnut artificially with hazel pollen, keeping the latter until the right moment for placing it upon the mature stigma of the walnut, after having removed all the male catkins before they opened. Such an experiment should give interesting results.

509 - **The Composition of Italian Wheats.** — TOMMASI G., MAROGNA G. and SICA V., in *Annali della R. Stazione Chimico-agraria sperimentale di Roma*, Series II, Vol. VIII, pp. 45-74, Rome, 1916.

CEREALS AND PULSE CROPS

The writers first examine the question of wheat-growing in Italy and the importance, not only of the quantity of the crop, but also of its composition. They then set forth, in a series of carefully compiled tables, the results of the analyses of wheats from the crops from 1910 to 1914, coming from different parts of Italy, and consisting of the most important Italian varieties, viz:

*Soft wheats:* Bianchetta — Calbigia — Campio — Carosella — Cologna — Veneta — Fucense — Gentil Bianco — Gentil Rosso — Maiorca — Awned Marzuolo Aducco (awned Aducco spring-wheat) — Marzuolo Ferrarese (Ferrara spring-wheat) — Marzuolo Veronese (Veronese spring-wheat) Marzuolo Americano (American spring-wheat) — Noé — Rieti — Romanello — Rosso d'Olona — Rosso piemontese.

*Hard wheats:* Biancuccia — Capoterra — Castiglione — Duro di Puglia (Apulia hard) — Gigante — Marzuolo — Russia — Sambucaia — Saragolla — Timilia — Vincetutti.

The total number of samples analysed were 69 (42 soft and 27 hard). From the results obtained, the writers found the average minimum and maximum values for the soft and hard wheats cultivated in different regions of Italy, and which are given below.

There are very considerable variations in the content of nitrogenous matters; nevertheless it never falls to a very small value, as may be observed in the wheats of other countries, which sometimes contain less than 10 per cent of nitrogenous matter. The dry gluten content was always over 8 per cent, the amount required for bread-making. It should also be noted that the proportion of gluten: nitrogenous matter varies within fairly wide limits; thus, there is not a perfect agreement between

these two sets of figures, so that it is not always the wheats which are richest in the total amount of nitrogenous matter that have the highest gluten content. The weight of the bushel does not vary very much, and the averages are fairly high. The aleurone content of the gluten is sometimes below 25, as calculated by BOLAND'S aleurometer, but it is well-known that this method of estimation is not very satisfactory, and the writers have only used it in comparing the results with those obtained from foreign wheats that had been previously analysed. The determination of the water content (on an average somewhat low) the fatty matter, cellulose, ash, phosphoric acid and pentosans gave no special results as compared with the analyses of foreign wheats.

*Composition of Italian Wheats.*

| | Soft Wheats | | | Hard Wheats | | |
|---|---|---|---|---|---|---|
| | Maximum | Minimum | Average | Maximum | Minimum | Average |
| Weight of the bushel . . . lbs | 65.8 | 57.7 | 63.3 | 67.1 | 60.6 | 65.2 |
| Weight of 100 grains . . . gr | 6.3 | 3.5 | 4.86 | 6.5 | 4.3 | 5.1 |
| Dry gluten . . . . . % | 16.0 | 8.3 | 10.6 | 16.6 | 9.0 | 10.7 |
| «Aleurometric» figure . . . . . | 40.0 | 25.0 | — | 3.0 | 25.0 | — |
| Humidity . . . . . % | 14.43 | 9.17 | 12.19 | 12.79 | 8.61 | 11.06 |
| *In* 100 *parts of dry matter*: | | | | | | |
| Fats (ether extract) . . . . . | 2.68 | 1.82 | 2.27 | 2.70 | 1.83 | 2.36 |
| Nitrogenous matter (N × 6.25) . . | 18.23 | 10.79 | 14.90 | 19.05 | 12.64 | 14.69 |
| Cellulose . . . . . | 3.98 | 2.16 | 2.77 | 4.02 | 2.17 | 2.91 |
| Ash . . . . . | 2.47 | 1.75 | 2.10 | 2.85 | 1.56 | 2.17 |
| Non-nitrogenous extract. (by diff.). | 82.34 | 74.35 | 77.96 | 80.21 | 72.97 | 77.87 |
| Pentosans . . . . . | 10.0 | 6.72 | 8.16 | 10.08 | 5.92 | 7.81 |
| Phosphoric acid . . . . . | 1.36 | 0.71 | 0.93 | 1.13 | 0.63 | 0.90 |
| Proportion dry gluten: nitrog. mat. | 1.08 | 0.65 | 0.79 | 0.98 | 0.70 | 0.83 |

On observing the averages, it is seen that hard wheats have a lower nitrogen content than soft wheats, although the two figures giving the maxima and minima are much higher in hard than in soft wheats. This agrees with WUAFLART'S statement:

" It is not true that a wheat ought always to be very rich in nitrogen; it should on the contrary be remembered that hard wheats are distinguished by their special consistency alone, and by their flour possessing particular properties that do not depend upon their content of nitrogenous matter ".

In conclusion, it may be observed that Italian wheats, in general, give proof of good physical qualities and excellent chemical composition ; they are distinguished from many foreign products by their high nitrogen content.

510 - **Spring Wheat Sowing in France : Manitoba Wheats and Rieti Wheat.** — I. *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. II, Nos. 4-6, pp. 82-83 ; 104-116 ; 141-155. Paris, January-February 1916. — II. *Bulletin de la Société d'Encouragement pour l'Industrie nationale*, Vol. 125, No. 1, pp. 158-167. Paris, January-February 1916. — III. *Journal d'Agriculture pratique*, Year 80, new Series, Vol. 29. No. 5 ; p. 101. Paris, March 9, 1916.

*I and II.* — The *Journal Officiel* of January 21, 1916 has published the statement of the sowings of cereals in the autumn of 1915. The data were obtained by an enquiry made by the Ministry of Agriculture. The result shows a decrease of 1826 143 acres, or of about 10 per cent of the area devoted to autumn cereals (wheat, rye and meslin (a mixture of wheat and rye), winter oats and winter barley), in comparison with the autumn of 1914, and a decrease of about 4200 870 acres in comparison with the normal area under wheat in the years before the war. The problem of the sowing of spring wheat is therefore one of particular interest to France this year.

As the best varieties of spring wheat, are mentioned : Noé, and still more its derivatives, Japhet, blé Dieu, Gros Bleu, Barbus à gros grains, Bordeaux, Pithiviers, Gironde. But since spring wheats are only grown on small areas in France, it is not easy to obtain seed. It will therefore be necessary to have recourse to foreign wheats, notably those of Manitoba which are in great favour with the French millers, and are much to be recommended. Manitoba wheats are certain to succeed in France wherever spring wheat can be grown. On account of their early ripening, they can be sown there up to the middle of April, or even a week or fortnight later in soil where there is no fear of drought, in fact, the atmospheric humidity of their country of origin justifies the belief that these wheats are relatively rust-resistant.

Manitoba wheat has been tested in Switzerland, where the growth conditions of winter wheats are generally less favourable than in France. Both in French and in German Switzerland, farmers use Manitoba wheat every year with success for spring sowing ; on good soil they can count upon from 37.2-44.6 bushels of grain per acre, and from 1.6-1.9 tons of straw per acre.

III. While fully recognising the importance of trying Manitoba wheats for spring sowing, M. GÉNIN is of opinion, that it would be well to first sow the varieties that have already been tested in France, and of which the success is certain. Such a wheat is the Rieti variety ; it is early and productive. It is more than 20 years ago since the writer introduced it into the old marshes of Bourgoin and Isère (18 533.25 acres). Before the introduction of this wheat, the cultivators of this district, which was drained in 1807, had, in the native wheats, only varieties with small grain, and stems liable to rust ; but since Rieti wheat has been introduced (which spread very

rapidly over the drained marsh), grain of first quality has been obtained both from autumn and spring-sown varieties.

M. SCHRIBAUX has tested this Rieti wheat, and has crossed it with Japhet, thus obtaining, some years ago, an awnless hybrid which the writer is growing successfully, and which he will soon be able to propagate on a large scale.

511 - **Rice-Growing in Italy.** — NOVELLI NOVELLO, in *Il Giornale di Risicoltura*, Year VI, No. 5, pp. 99-104 + 1 Geographical Map. Vercelli, March 16, 1916.

In Europe, Italy is the country which occupies the first place in the development of rice-growing, about 380 665 acres being under this cereal annually while 27 000 000 bushels of paddy are produced giving the value, together with that of its by-products, of over £ 6 000 000. It is estimated that rice is grown in rotation on about 2 223 990 acres of irrigated land.

In 1911, about 2 128 000 bushels of prepared rice were exported, of which the value was more than £ 1 200 000. Not very long ago, this crop was of still greater importance ; during the five-years period 1870-1874, it occupied 573 295 acres. Rice growing afterwards decreased, on account of the severe competition of Asiatic rice, great injury due to diseases etc. The rice growing provinces, in decreasing order of the area cultivated, are at present the following : Novara, Pavia, Milan, Bologna, Mantua, Rovigo, Verona, Ravenna, Alexandria, Cremona, Venice, Reggio d'Emilia, Lucca, Udine, Padua, Ferrara, Vicenza, Modena, Bergamo, Syracuse, Campobasso, Naples. Rice-growing tends to decrease a little in the districts where it was most extended, with the gradual transformation of permanent rice fields into rotation rice fields, and also with the adoption of a more systematic succession of crops increasing the unit production. On the other hand, rice-growing is noticeably extending in some irrigated districts where it had been of little importance. This is due, not only to its utility in clearing the ground from weeds, but also to the profit derived from the product. Rice is especially cultivated in the Provinces of Bologna and Ravenna, and in the low lying zones of Venetia, where it assists in the continual reclaiming of waste marsh land, for rice is often the first transition crop in the agricultural improvement of this land.

This work of reclaiming the numerous marshes, or lands periodically subject to flooding, which exist in Italy, can be increased in future, thanks to the transplanting method which the experimental Rice-Growing Station at Rieti (directed by the writer), has, after study and experiment, already introduced and popularised in Italy. This system allows of rice being grown, even on land that is always slightly submerged, or which is subject to flooding in spring, and where a sown crop would be impossible, or very soon destroyed.

512 - **Gram Cultivation (*Cicer arietinum* L.) in India.** — HOWARD ALBERT, HOWARD GABRIEL L. C. and ABDUR RAHMAN KHAN, in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. VII, No. 6, pp. 215-235. 2 figs. Calcutta, 1915.

This Bulletin is entirely devoted to the etudy of the cultivation of gram in India where the area under this plant every year is about

18 000 000 acres. The grain is an important food for man and cattle, while the dried stems ande leaves are used as fodder.

The factors affecting the yield are: the nature of the soil; the special conditions of the climate at the flowering season; the time of sowing; and the specific productivity of the different types.

The distribution of gram depends chiefly upon geological and agricultural conditions; this plant requires a light, open, well aerated soil for the normal development of the root system and the formation of nodules. In heavy, argillaceous, moisture retaining soil, gram grows with difficulty, the root-system is very superficial and only a few pods set seed. Thus on the alluvial district of the Gangees gram is only grown on 176000 acres, as against 175433 acres in the Province of Agra where the soil is a somewhat sandy, open, well drained loam passing towards Bengal into an exceedingly fine silt of high moisture retaining capacity. As the soil alters in texture towards Bengal, so the area under gram falls. On such soils, the shallow-rooting, erect and early flowering varieties should be grown, in order that the roots may not encounter, in their growth, increasingly disadvantageous conditions likely to greatly impede their development.

Another factor that has much effect on *Cicer arietinum* is the damp due to wet and cloudy weather which, when it occurs during the flowering season, prevents the setting, as is shown by the following data:

| Variety | Effect of rainy weather on setting | | | Effect of fine weather upon setting | | |
|---|---|---|---|---|---|---|
| | No. of flowers | No. of pods formed | Percentage set | No. of flowers | No. of pods formed | Percentage set |
| Type 23. . . . . | 18 | 2 | 11 | 18 | 15 | 83 |
| «Large Kabuli» . . . | 18 | 4 | 22 | 18 | 13 | 72 |
| Type 22. . . . . | 21 | 5 | 25 | 21 | 17 | 81 |
| Type 21. . . . . | 19 | 1 | 5 | 19 | 12 | 63 |
| Type 20. . . . . | 20 | 9 | 45 | 20 | 18 | 90 |

The time of flowering is of importance in several ways and should be taken into consideration; in all selection work, preference should be given to the types flowering at the end of the cold weather, when the season begins to change and the days are generally bright and warm, thus promoting pollination. There is then ample time for the seed to set before the hot damp winds begin. Excessive earliness in flowering is associated with low yielding power, while on the other hand, very late flowering is a disadvantage, as a rapidly ascending temperature interferes with the normal development of the grain.

As regards the date of sowing, the best results were obtained at Pusa when the crop has been put in rather late, during the first week in November, by which time the light lands have had time to lose a good deal of their moisture. Late sowing, as has been seen, checks excessive vegetative growth developed at the expense of seed production. The yield finally depends upon the productiveness of each variety. The large seeded varieties have only one seed in each pod. The colour of the seeds varies from white to black through various shades of yellow and red. The lighter the colour of the seeds, the higher their price ; thus the colour is a new element serving as a guide in the work of selection.

The white gram, type No. 9, is interesting from its habit, which is very spreading with numerous side branches. This type unites both yield and quality ; it has been grown for 4 years at Pusa, and under the most different soil and climatic conditions has always yielded an average of over 20 maunds (1642 lbs) per acre.

The writer finally gives a classification and description of the various types, 25 of which have, so far, been isolated at Pusa, and are distinct in habit, size and colour of flowers, the shape and colour of the different parts of the corolla, as well as in the colour and dimensions of the leaves and seeds.

STARCH CROPS

513 – **Experiments Carried out in 1915 by the German Station for Potato Cultivation** (1). — Von Eckenbrecher F., in *Zeitschrift für Spiritusindustrie*, Year 1916, Suppl. No., pp. 1-52. Berlin, 1916.

In 1915, the above-mentioned Station (" Deutsche Kartoffel kulturstation " directed by the writer) tested 19 varieties of potatoes on 32 fields situated in different parts of Germany, namely : East and West Prussia ; Posen ; Pomerania ; Brandenburg ; Silesia ; Prov. of Saxony ; Brunswick ; Hanover ; Anhalt ; Kingdom of Saxony ; Hesse ; Bavaria ; Würtemberg ; Grand-duchy of Baden. A new experiment field was started in West Prussia. The experiments proceeded sufficiently normally to give reliable results.

In these experiments, each variety occupied a plot of 2.5 ares (300 square yards). At the time of ploughing, in autumn, or the beginning of winter, an amount of stable manure corresponding to about 318.5 cwt per acre was dug in, subsequently in the spring, 35.68 lbs. of soluble phosphoric acid and 28.54 lbs. of nitrogen were added.

The number of seed potatoes used should, if possible, be the same for all varieties ; and all the potatoes ought to be planted at the same time, but the Station gives no directions as to the method of cultivation.

During the summer, the experiment fields should be cleared of weeds and well cared for. They are superintended by an inspector, who at the same time gives the farmers advice to insure the satisfactory development of the plants.

The lifting, sampling, estimation of the diseased tubers and the estimation of the starch content, etc., are carried out according to the directions given by the Station ; these are reproduced by the writer.

(1) The results of the 1914 experiments are summarised in *B.* May 1915, No. 495. (*Ed.*)

TABLE I.

| | Classification According to Tuber yield | | | | | Classification According to Starch yield | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Varieties | Amount of Starch % | Tuber yield cwt. per acre | Starch yield cwt. per acre | Ripening | Varieties | Amount of Starch % | Tuber yield cwt. per acre | Starch yield cwt. per acre | Ripening |
| 1 | Deodora | 18 % | 258.2 | 45.8 | semi-late | Parnassia | 19.7 | 251.9 | 49.6 | semi-late |
| 2 | Parnassia | 19.7 | 251.9 | 49.6 | » | Deodora | 18 | 258.2 | 45.8 | » |
| 3 | Ursus | 18.4 | 226.4 | 41.7 | late | Roode Star | 19.8 | 211.0 | 41.9 | » |
| 4 | Gedymin | 18.1 | 222.9 | 40.3 | semi-late | Ursus | 18.4 | 226.4 | 41.7 | late |
| 5 | Prof. Gerlach | 18.3 | 211.6 | 38.7 | » | Gedymin | 18.1 | 222.9 | 40.3 | semi-late |
| 6 | Roode Star | 19.8 | 211.0 | 41.9 | » | Wohltmann 34 | 19.1 | 206.6 | 39.8 | late |
| 7 | Boehm's Erfolg | 18.7 | 205.4 | 38.6 | » | Prof. Gerlach | 18.3 | 211.6 | 38.7 | semi-late |
| 8 | Wohltmann 34 | 19.1 | 206.6 | 39.8 | late | Boehm's Erfolg | 18.7 | 208.4 | 38.6 | » |
| 9 | Prof. v. Eckenbrecher | 15 | 204.1 | 30.7 | semi-late | Präs. v. Klitzing | 18.1 | 195.0 | 35.2 | » |
| 10 | Präs. v. Klitzing | 18.1 | 195.0 | 35.2 | » | Attyk | 18.4 | 184.5 | 34.2 | » |
| 11 | Gertrud | 17.9 | 191.1 | 34.1 | » | Gertrud | 17.9 | 191.1 | 34.1 | late |
| 12 | Excellenz | 17 | 190.7 | 32.6 | » | Landrat v. Ravenstein | 18.1 | 180.1 | 32.6 | semi-late |
| 13 | Attyk | 18.4 | 184.5 | 34.1 | late | Excellenz | 17.0 | 190.7 | 32.6 | » |
| 14 | Richter's Imperator | 17.3 | 182.7 | 31.3 | semi-late | Prof. Wohltmann | 18.5 | 173.9 | 32.4 | late |
| 15 | Landrat v. Ravenstein | 18.1 | 180.1 | 32.6 | » | Richter's Imperator | 17.3 | 182.7 | 31.3 | semi-late |
| 16 | Geheimrat v. Rümker | 16.9 | 175.1 | 29.6 | » | Prof. v. Eckenbrecher | 15 | 204.1 | 30.2 | » |
| 17 | Prof. Wohltmann | 18.5 | 173.9 | 32.4 | late | Geheimrat v. Rümker | 16.9 | 175.1 | 29.6 | » |
| 18 | Labersche | 17.8 | 141.4 | 25.2 | semi-late | Labersche | 17.8 | 141.4 | 25.2 | » |
| 19 | Zukunft | 15.5 | 112.8 | 17.8 | » | Zukunft | 15.5 | 112.8 | 17.8 | » |
| | Average | 246.4 | — | — | — | Average | 17.9 | — | — | — |

| Period or Year | Average yield of tubers in cwt. and lbs per acre | | Average Amount of Starch % | Average Starch yield lbs per acre |
|---|---|---|---|---|
| | cwt | lbs | | |
| 1888–1892 | 171 | 78 | 19.0 | 3700 |
| 1893–1897 | 185 | 80 | 18.9 | 3900 |
| 1898–1902 | 200 | — | 19.0 | 4200 |
| 1903–1907 | 187 | 56 | 18.2 | 3800 |
| 1908–1912 | 181 | 28 | 18.1 | 3700 |
| 1913 | 212 | 56 | 17.5 | 4100 |
| 1914 | 166 | 108 | 18.3 | 3500 |
| 1915 | 196 | 48 | 17.9 | 4000 |

In 1915, the weather at the beginning of the growing period was unfavourable to potato cultivation : later, owing to the copious rain, the leaves, haulms, and tubers were able to develop well ; starch formation was, however, hindered by the rain ; and towards the end of September, the frosts injured the late varieties.

In Table I, the various kinds are classified according to their tuber and starch yield per acre, while in Table II, the results obtained in 1915 are compared with those of the preceding years. From these data it appears, that in 1915, the average tuber yield per acre of all the varieties exceeded by 3291 lbs. that of 1914 ; while the amount of starch was 0.4 per cent lower, and the starch yield per acre exceeded 5085 lbs, Amongst all the years of experiment, 1915 occupies : the 9th place as regards the tuber yield ; the 20th for the amount of starch ; the 12th for the starch yield. The tuber crop in most fields exceeded the 1914 crop, but on account of the rainy weather, the amount of starch had decreased.

A certain number of varieties that had given satisfaction in previous years were disappointing in 1915 and vice-versa. The sorts giving good results in the previous years (including 1915) are :

Deodara (tested twice) — Ursus (once) — Gedymin (once) — Prof. Gerlach (3 times) — Roode Star (3 times) — Prof. Eckenbrecher (twice) — The Parnassia variety was grown for the first time in 1915.

The following kinds, which were still satisfactory in 1913 and 1914, no longer did well in 1915 :

Präsident Klitzing — Gertrud — Eccellenz Attyk — Landrat von Ravenstein — Geheimrat von Rümker — Zukunft never gave good results and must be considered as the least satisfactory.

With regard to resistance to disease, the writer remarks that the largest number of diseased tubers were observed in the following varieties :

Geheimrat von Rümker (5.5 per cent of diseased tubers — Präsident von Klitzing (4.5 per cent) — Dabersche (3.7 per cent) — Richters Imperator (3 per cent).

The smallest number of diseased tubers were found in :

Deodara — Gedymin and Prof. Wohltmann (0.5 per cent) — Wohltmann 34 — Roode Star — Boehm's Erfolg (0.4 per cent) — Parnassia (0.2 per cent).

The writer also mentions the frequency of the occurrence of the different diseases (Phytophthora etc.) in the case of different varieties of potatoes.

The tubers, when stored in cellars, kept fairly well, both in 1914 and 1915, and from this point of view, may be classified as follows.

*Good to very good :* Deodara — Wohltmann 34

*Good :* Prof. Gerlach — Gedymin — Prof. Wohltmann — Excellenz — Ursus — Gertrud — Attyk.

*Fairly good to good :* Landrat von Ravenstein — Dabersche — Prof. von Eckenbrecher — Präsident von Klitzing — Roode Star — Zukunft.

*Fairly good :* Geheimrat von Rümker — Richter's Imperator.

In conclusion, the writer gives information regarding the general value of each variety, and its value as an article of human food.

FORAGE CROPS. MEADOWS AND PASTURES

514 - **Breeding of Drought-Resistant Millet and Sorgo in the Great Plains Region of the United States.** — DILLMAN A. C. in *U. S. Department of Agriculture Bulletin*, No. 291, 10 pp. 2 plates, Washington, January 25, 1916.

It has been found by experience that successful farming in the Great Plains region must include the raising of live stock. This necessitates the production of forage crops under cultivation, since except in sand-hill regions and along the water courses, the native grasses do not grow tall enough for hay. The wild short grasses that cover the Plains usually produce feed for summer pasturage, but cultivated crops must be depended upon for winter feeding. In the northern Great Plains, certain perennial crops — lucerne and species of *Bromus* — give good results, but farther south, the annual forage crops, millet and sorgo especially, are the most dependable and have proved drought resisting and capable of producing profitable crops where the annual rainfall averages from 12 to 18 inches.

The drought-resistance of millet is largely due to its early maturity and low water requirements, while sorgo has in addition to these two valuable characteristics, a remarkable ability to endure drought. Even though its growth is severely checked during a period of drought, it will resume growth upon the return of favourable conditions. It has been shown that millet and sorgo require less water for the production of a ton. of hay than any other crops that have been tested in the central Great Plains.

BRIGGS and SHANTZ found from practical experiments carried out at Belle Fourche (S. Dak) that in order to produce a given quantity of dry matter, millet had a water requirement of 240, as compared with 460 for wheat and 735 for lucerne. In experiments conducted at Akron (Colo.), the same writers found that the water requirement of sorgo is only slightly higher than that of millet.

The " Kursk " and " Siberian " varieties of millet have given larger

yields of hay than other varieties of this crop tested in the northern Great Plains. In each of these varieties, a strain has been selected which is believed to be much superior to the parent stock. One of these selections, " Dakota Kursk millet " is an early variety of good forage type. The plants are 30 to 34 inches high when mature, have a number of rather fine stems, and many leaves. The yield of hay from this variety has averaged 2 1/4 tons per acre at Akron (Colo.) and 1 3/4 tons at Newell, S. Dak. In seed production this variety is excellent, producing under ordinary conditions from 15 to 25 bushels per acre. The seed head is close and firm and does not allow the seed to be shed readily. " Siberian millet " is a larger type of millet than " Dakota Kursk ", growing from 36 to 40 inches high. It has coarser stems and leaves and makes a somewhat poorer quality of hay. It does however produce a larger yield per acre than the " Dakota Kursk ", while the seed sheds more readily. In regions of greater rainfall, this variety may be more valuable than " Dakota Kursh " on account of its higher yield, but for the northern Great Plains it is believed that the latter variety is the better type.

A strain of early sorgo is much needed for cultivation in the northern Great Plains, where at the present time very little sorgo is grown. A strain of sorgo has been developed by selection which is especially promising for this region and for higher altitudes farther south in the Great Plains. In favourable seasons, the large growing sorgos produce a heavier yield than this dwarf type, but in dry seasons, the latter will yield at least as heavily as the larger varieties. This type is very early, maturing seed in a period of about 90 days, and can often be used as a catch crop where other crops fail. It produces seed freely, and the farmer can easily raise his own supply of seed for forage planting. On account of the smaller size of the plants, this dwarf sorgo can very well be planted thicker than the larger growing varieties. This new variety has been named " Dakota Amber Sorghum ".

Sorghum will probably produce a heavier yield of fodder than any other annual forage crop of this region. At Akron (Colo.) sorgo has produced 40 per cent greater yields than millet. At Newell and Ardmore (S. Dak.) the results have also been in favour of sorgo. In a 7 year test at Newell, sorgo produced 51 per cent more fodder than maize. " Dakota Amber sorghum " has produced on the average 40 per cent more forage per acre than " Sudan grass (1) in tests at Newell, Akron, Ardmore and Mandan.

It is believed that " Dakota Kursk " millet and " Dakota Amber Sorgo " will prove valuable additions to the list of forage crops adapted to the north and central Great Plains.

515 - **Sorghum (*Sorghum exiguum f. maxima*) in North Africa** (2). — TRABUT in *Le Progrès Agricole et Viticole*, Year 23, No. 10, pp. 235-237. Paris, March 5, 1916.

The sorghum called in the United States " Sudan Grass ", and " Tunis Grass ", and which comes from Khartum and Algiers, is very nearly

(1) See also *B.* July 1913, No. 799. (*Ed.*)
(2) See also *B.* January 1916 No. 42. (*Ed.*)

related to the wild form *Andropogon halepensis* with which it has been confused, although different in several characters. Thus, while the Aleppo sorghum has spreading rhizomes which form a coarse dogs-grass much disliked by cultivators, *Sorghum exiguum* does not spread and its stem is straight and of small diameter, thus justifying the name of *Holcus exiguus* under which it is described by FORSKAL in the *Flora Aegypto-arabica*. The inflorescences are sometimes very reduced, as in the Egyptian type, or large and diffuse. The spikelets are always jointed, and are easily detached when ripe.

In Kabylia, the writer observed a very tall variety called " Mezza " by the natives, which seems to mark the transition to the cultivated forms, although it undergoes no modification when cultivated.

*Sorghum exiguum* f. *maxima* is well suited to southern climates and to more or less arid soils; on damp soil, or one that is irrigated, it can yield at least 2 cuttings. It grows well in association with a leguminous plant; with *Dolichos Lubia* or with *Soja*, sorghum has given good results. The grain is easily harvested; it is only necessary to cut the ripe inflorescences and expose them in a dry place; then when they are shaken, the seeds which were previously enclosed in the glumes at once fall out, as in the case of the broom sorghum and the sugar sorghums.

Feeding experiments have shown that no bad effects are produced if the sorghum is cut after flowering, and fed to cattle 24 hours after being cut.

516 - ***Gossypium Paolii* n. sp. and *G. Benadirense* n. sp. New Varieties of Indigenous Cotton in Italian Somaliland.** — MATTEI G. E., in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. II, Part 4, pp. 221-224. Palermo, 1916. FIBRE CROPS

In 1908, the writer declared to be identical with *Gossipium obtusifolium* Boxl. var. *africanum* Watt, a cotton plant growing wild in the district of Mogadiscio (Italian Somaliland) and which is perhaps a natural and fertile cross of sufficiently fixed characters between the true *G. herbaceum* L. (the variety first cultivated in Africa) and *G. Stockii* (mentioned as growing wild in Arabia and perhaps in some parts of East Africa). On examining the collection of *Malvaceae* made in Somaliland in 1913 by Prof. G. Paoli, the writer discovered the existence of 2 other species of cotton which are new to science and which he described under the names of *G. Paolii* and *G. Benadirense*.

These 2 varieties are very similar to one another, and are without doubt wild, native plants that have not been affected by any crossing.

517 - **Arborescent Cotton Plants** (1). — RIVIÈRE C. in *Bulletin de la Société Nationale d'Acclimatation de France*, Year 63; No. 2, pp. 46-55. Paris, February 1916.

Basing his opinion upon the history of the 2 arborescent cotton plants " de Motril " and " Caravonica ", the writer maintains that the cotton

(1) See Bulletin de la Société nationale d'acclimation de France, March 1, 1914, p. 138 et seg. (*Ed.*)

plant is capable of infinite variation, especially as regards its general aspect, and that it is much affected by its environment, and the method of its cultivation. From this it results that the habit, the shape of its leaves, the size of its inflorescence, as well as the length and character of its staple are not fixed characters upon which economic cultivation can be based, but that preliminary experiments are necessary in order to determine the qualities of the plant. The writer regards the " de Motril " cotton plant as nearly related to *Gossypium Hardyanum* described by TODARO as coming from the Algiers Experimental Gardens and which, according to the writer, is a long stapled " Georgia " much resembling the " Sea Island " variety, from which also " Caravonica " is derived. The latter, upon which such great hopes were built, had a strong tendency to degenerate into common varieties, and under various circumstances gave disastrous results. As experimental proof of his hypothesis, the writer reminds us that some neglected plants of *Gossypium herbaceum*, found by him on the dunes of Biserta, produced, in the Algiers Experiment Garden, individuals with luxurious growth which certainly did not look as if they had a common origin. On the other hand, in the reverse experiment, plants raised from the seed of equally fine individuals, when left to themselves under unfavourable soil conditions and without any care, produced offspring to which different origins, both as regards country and race would certainly have been attributed.

518 – **The Introduction of the Cultivation of Egyptian Cotton into the South West of the United States.** — SCOFIELD T. H., KEARNEY T. H., BRAND C. S., COOK O. F., and SWINGLE W. T. (Committee on Southwestern Cotton Culture). in *U. S. Dep. of Agric. Bulletin* No. 332, pp. 1-30. Washington, January 13, 1916.

This publication of the " Committee on Southwestern Cotton Culture " dealing with the establishment of Egyptian cotton production in the Salt River Valley (Arizona) is of more than local interest, since it offers a good illustration of the numerous biological, agronomic, social and economic difficulties encountered in developing a new agricultural industry and furnishes suggestions as to how these problems may be successfully solved. In the course of the work carried out under the direction of this Committee, it has been shown that cooperation is the key-note of the success of the present enterprise. In this instance, cooperation has been maintained chiefly along the following lines :

1) Among the investigators, who had to solve special technical problems and coordinate the results in such a manner that their collective judgment should point out the general line to be followed.

2) Among the growers, in order to make it possible to produce and market the crop economically and to maintain the uniformity and high price of the variety grown.

3) Between the growers and the investigators, to make it possible to put into effect, without delay, the most improved methods of production and marketing. This cooperation has been maintained by personal contact, by keeping on the spot the field agents of the Department of Agriculture who have worked constantly in the community. These agents have been

under the direct control of the Committee, some of the members of which have made frequent visits to the salt River Valley plantations. The altitude of the officers and members of the growers' associations in their co-operation with the Department of Agriculture has been of the most cordial and helpful character, and has been a very important factor in the establishment of the industry.

4) Between the cotton manufacturers and the investigators representing the growers' associations. Spinning tests have been made and information of a technical and commercial nature given. This information has guided the growers to better methods of packing and of managing the crop generally, and has given the investigators helpful suggestions in connection with the work of selection.

Some of the manufacturers interested in the new type of native cotton, visited the plantations, while representatives of the growers visited the mills where the cotton was being utilised.

The policy of the Department of Agriculture in encouraging the production of Egyptian cotton on the community basis, is beginning to be appreciated by manufacturers and buyers, many of whom now realize that in order to obtain a constant type of long-stapled cotton, they must look to localities where the farmers are organised to grow only one kind of cotton, to prevent deterioration of the type by seed selection, and to class and market their crop as a whole.

519 - **Experiments in Growing *Arachis hypogoea* in Eastern Uruguay.** — PUIG Y NATTINO JUAN, in *República oriental del Uruguay*, Ministerio de Industrias, Inspección Nacional de Ganadería y Agricultura, Boletin No. 17, 18 pp. + 2 figs. + XVIII Plates, + 4 diagrams. Montevideo, 1916.



Experiments carried out by the " Laboratorio agronómico de la Inspección Nacional de Ganadería y Agricultura ", of which the writer is Director.

In Uruguay, the ground nut is cultivated on an area of scarcely 3706 acres, and the crop forms an unimportant article of export, With a view to ascertaining what chance there would be of extending this industry, the writer grew the 2 varieties wrongly called " Asiatic ", and " African " or " Japanese ", on 10 plots of the experiment field at Sayago. Each plot was treated differently, and the seed was sown at the rate of 89 lbs. per acre at the beginning of November; the harvest taking place at the end of April, or the beginning of May.

In a series of tables are set forth : the cultural operations : the analyses of the seed ; the analyses of the crop : analyses of the soils used in the experiment ; the metereological data.

The yield varied from 1829 to 2428 lbs. per acre in the case of the 4 best plots ; and between 613 and 1331 lbs. per acre in that of the others. The first set of figures agrees with the normal crops obtained in countries where *Arachis* is usually cultivated. It must, however, be remembered that the seed was sown late and that the distribution of the rainfall was abnormal (36.5 in.), during the whole growing period of November-May. Superficial cultural operations proved useful in the experiment field where the soil

was more or less compact. Some of the chief data contained in the tables vary within the following limits :

| | | per cent |
|---|---|---|
| Proportion between husk and seeds | Husks | 27 — 28 |
| | Seeds | 70 — 72 |
| Water Content | Entire fruit | 6 — 7 |
| | Seed : " Asiatic " var. | 5.5 |
| | seed : " Japanese " var. | 9.5 |
| Yield of Oil | Entire fruit dry | 26 00 — 37.50 |
| | Seed : " Asiatic " var. | 47.50 — 48.40 |
| | Seed : " Japanese " var. | 41.88 — 44.07 |
| Analysis of seeds | Protein | 20.81 — 26.63 |
| | Ash | 2.06 — 2.55 |

The writer recommends the cultivation of the ground-nut on every uruguayan farm, on a small scale, for home consumption. The experiments (which will be continued), have already shown that this plant is very well adapted to the country.

520 – **Experiments in the Royal Colonial Gardens at Palermo on the Cultivation of Sunflowers Imported from Russia.** — TROPEA C., in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. II, Part 4, pp. 214-220. Palermo, 1916.

While continuing the experiments in growing sunflowers imported from Russia in the Royal Colonial Gardens at Palermo (1), it was noticed in 1915, that the 2nd generation of the plant had become differentiated into 3 forms having respectively black, white, and spotted seeds. The seeds that came from Russia were all spotted and retained this character, even in the 1st harvest. Any possibility of crossing having taken place during the experiments must be excluded. The most probable hypothesis is, that the Russian seed is that of a fixed hybrid which, owing to its acclimatisation in a new country, has split up into its 2 ancestral forms. Further, many of the plants grow slender and low, with many small concave capitula (that is to say, having their central seeds aborted), so that the total yield was 1918 lbs. per acre as against 4816 lbs. per acre in the case of the 1st generation. On eliminating all the badly grown plants, however, it was calculated that the crop of the 2nd generation amounted to 5867 lbs. per acre, The writer therefore tried to ascertain which of the 3 forms in the non-eliminated plants gave the highest yield. The results of his researches. which are given in the following table, prove the superiority of the type with white seeds, and this he intends to improve by selection.

(1) See B. June 1915, N.° 615. (*Ed.*).

*Characters of the 3 forms of sunflower obtained from spotted seed imported from Russia.*

| | White seeds | Black seeds | Spotted seeds |
|---|---|---|---|
| Average height of plants . . . . . in. | 122.05 | 114.17 | 110.24 |
| Average diameter of stems . . . . . in. | 1.65 | 1.54 | 1.54 |
| Average diameter of heads . . . . . in. | 13.78 | 13.98 | 11.81 |
| Average diameter of seeds . . . . . mms. | 5.3–7.5–11.8 | 4.8–7.2–12.9 | 4.7–7.2–11.7 |
| Total weight of seeds per capitulum . . oz. | 11.0 | 11.0 | 8.0 |
| Number of seeds per capitulum . . . . . | 2 160.0 | 2 312.0 | 1 831.0 |
| Average weight of 1 000 seeds . . . . . oz. | 5.26 | 5.0 | 4.0 |
| Average volume of 1 000 seeds . . . cub. in. | 24.0 | 21.0 | 20.0 |
| Yield per acre . . . . . lbs. | 11 419.0 | 4 603.0 | 4 282.0 |
| Oil yield (of 100 grms. of seed) . . . . . % | 19.833 | 21.417 | 21.700 |
| Oil yield per acre . . . . . lbs. | 2 264.0 | 985.0 | 929.0 |

521 – **The Tannin Contents of some Queensland Barks.** — BRÜNNICH J. C. and JEFFERIS A. T. in *Queensland Agricultural Journal*, New Series, Vol. V, Part 2, pp. 104-106. Brisbane, February 1916.

CROPS YIELDING OILS, DYES AND TANNINS

With the view of commencing a general survey of Queensland barks, the writers have analyzed a number, particularly from those woods which are valuable for timber, as a valuable by-product of the timber industry might be saved and utilised, should the bark of such be found to contain fair percentages of tannin, These results are tabulated in three divisions : 1) Barks containing over 20 per cent of tannin : such should have direct value as tanning material : 2) Barks containing between 10 per cent and 20 per cent of tannin : these might become of value for the making of extracts, particularly where the bark occurs on large trees which are felled for timber ; 3) Barks containing under 10 per cent of tannin : these are probably valueless, though some of the higher ones might be of use for extracts.

As regards Acacias, *A. implexa* is rich in tannin and should be of value. « Brigalow » (*A. harpophylla*) is of considerable interest, being widely distributed throughout the near West and common on the pear-infested land of Queensland. It is used locally for tanning purposes, especially the inner bark. « Tallow-wood » (*Eucalyptus microcorys*) is a coastal tree, but is becoming rather scarce. « White » or « Scrub gum » (*E. haemastoma*) occurs on poor dry ridges in the South Coast districts of Queensland, and is used largely for fencing and firewood. « Gympie Messmate » (*E. Cloeziana*), occurs fairly abundantly in the neighbourhood of Gympie. The tree is large

and yields a useful hardwood. Though the bark as a whole is not very rich in tannin, the inside bark, which is approximately one-half the total thickness, contains considerable over 20 per cent, and might be of considerable value. The following are some analyses of samples collected.

| Botanical name | Local name | Per cent moisture | Per cent soluble matter | Per cent non tannin | Per cent tannin |
|---|---|---|---|---|---|
| Over 20 per cent tannin: | | | | | |
| *Acacia* sp. (undetermined) . . . . | Black Wattle | 9.38 | 34.60 | 9.72 | 24.88 |
| *A. implexa* . . . . . | | 6.50 | 30.30 | 8.02 | 22.28 |
| *Eucalyptus Cloeziana* (inside bark) . | Gympie Messmate | 7.42 | 31.50 | 8.02 | 23.48 |
| Over 10 per cent tannin: | | | | | |
| *Acacia Cunninghamii*. . . . . | | 3.05 | 22.98 | 5.36 | 17.62 |
| *A. arundelliana* . . . . . | | 5.50 | 25.78 | 8.32 | 17.46 |
| *A. neriifolia*. . . . . | | 5.15 | 22.65 | 11.30 | 11.35 |
| *A. harpophylla* . . . . . | Brigalow | 5.24 | 30.24 | 14.10 | 16.14 |
| *Eucalyptus paniculata* . . . . . | | 10.35 | 23.16 | 8.63 | 14.53 |
| *E. microcorys* . . . . . | | 8.13 | 29.44 | 11.78 | 17.66 |
| *E. haemastoma*. . . . . | | 9.45 | 21.92 | 9.95 | 11 97 |
| *E. Cloeziana* (whole bark) . . . . | Gum-topped Ironbark | 6.30 | 18.55 | 6.40 | 11.95 |
| *Alphitonia excelsa* . . . . . | Red Ash | 8.00 | 15.62 | 4.48 | 11.14 |
| Under 10 per cent tannin: | | | | | |
| *Acacia* sp. . . . . | Scrub Wattle | — | — | — | 8.50 |
| *Eucalyptus maculata* . . . . . | | — | — | — | 5.82 |
| *Eucalyptus* sp. . . . . | Ironbark | — | — | — | 6.70 |
| *Podocarpus pedunculata*. . . . . | Black Pine | — | — | — | 8.30 |
| *Cardwellia sublimis* . . . . . | Bull Oak | — | — | — | 5.00 |
| *Eugenia* sp. . . . . | Scrub mahogany | — | — | — | 8.30 |
| *Elaeocarpus grandis* . . . . . | Quondong | — | — | — | 5.70 |

Blue Gum (*Eucalyptus tereticornis*), *Callitris Parlatorei*, Turpentine (*Tristania suaveolens*), Crowfoot Elm (*Tarrietia argyrodendron*), River Oak (*Casuarina Cunninghamiana*), Kurragong (*Sterculia* sp.), Red Beech (*Flindersia Chatawaiana*) and Tallow wood contain from 4.0 to 4.9 per cent of tannin: Narrow- leaf Wattle (*Acacia* sp.), *Eucalyptus acmenioides*, Blood wood (*E. corymbosa*), Yellow String Bark (*E. eugenioides*), Scented Gum (*E. citriodora*), Sarsaparilla, Sassafras (*Daphnandra aromatica*) from 3.0 to 3.64 per cent ; Bally Gum (*Litsea ferruginea*), White Silky Oak, Candlenut (*Aleurites moluccana*), White Cedar (*Melia composita*), Black Walnut (*Cryptocarya Palmerstonii*), Jimmy-Jimmy (*Amoora nitidula*) from 2.1 to 2.8 per cent, etc.

522 – **Manurial Experiments with Young Rubber at Kuala Lumpur F. M. S.** (1). — SPRING F. G. (Agriculturist) in *The Agricultural Bulletin of the Federated Malay States*, Vol. IV, No. 4, pp. 105-110. Kuala Lumpur, January 1916.

These experiments have now been continued for a period of 4 years, during which period the effect of the treatment has been estimated in terms of increase in girth of the trees. As these trees have now reached the tapping stage the next years results will be based on yields of rubber.

The manures were applied in circles round the trees and lightly forked in. Quicklime was used in each case and allowed to slake naturally before spreading. The lime and basic slag was always applied several weeks before the other manures. The number of trees in each plot was 120 at the beginning of the experiment but was finally reduced to 100.

The scheme of manuring and summary of results is as follows :

| Plots | Total increase during 4 years | Excess increase in girth | | | | Total excess over control during 4 years |
|---|---|---|---|---|---|---|
| | | over 1st year | control 2nd year | plots 3rd year | 4th year | |
| | inches | inches | inches | inches | inches | inches |
| Sulphate of ammonia and lime. . . . . | 23.69 | 1.36 | 0.19 | 0.98 | 0.42 | 2.95 |
| Sulphate of ammonia; sulphate of potash and lime. . . . . | 21.55 | 1.23 | 0.04 | 0.54 | — 1.00 | 0.81 |
| Sulphate of ammonia; double superphosph. and lime. . . . . | 23.21 | 1.87 | 0.28 | 1.66 | — 1.34 | 2.47 |
| Double superphosphate; sulphate of potash and lime. . . . . | 22.11 | 1.87 | 0.51 | 0.83 | — 1.84 | 1.37 |
| Sulphate of ammonia; double superphosph.; sulphate of potash; lime. . . . . | 24.28 | 2.35 | — 0.01 | 1.53 | — 0.33 | 3.54 |
| Lime. . . . . | 22.22 | 1.05 | — 0.58 | 0.30 | 0.31 | 1.08 |
| Sulphate of potash; lime . . . . . | 22,55 | 1.12 | 0.24 | 0.20 | — 0.18 | 1.38 |
| Double superphosphate; lime. . . . . | 22.68 | 1.87 | 0.26 | — 0.16 | — 0.43 | 1.54 |
| Sulphate of ammonia; double superphosph.; sulphate of potash. . . . . | 22.80 | 1.48 | 0.15 | — 0.30 | 0.33 | 1.66 |
| Control . . . . . | 21.14 | | | | | — |
| | | Manured | No manure applied | Manured | No manure applied | |

The quantities of manure applied per tree were as follows : sulphate of ammonia ½ lb ; sulphate of potash 1 lb ; double superphosphate 1½ lbs ; lime 1 000 lbs per acre.

Reviewing the results of the 4 years it is noticeable that during the first

(1) See also *B.* Nov. 1915, No. 1153. (*Ed.*).

year, the trees in the manured plots in every case showed a good excess in girth measurements over the trees in the manured plots. In the second year there was no manure applied when the average girth increase was about equal to that of the control plot, showing that the effect of the unmanures did not continue beyond the first year. At the beginning of the third year a second application of manure was applied but the effect as measured by increase in girth was less than that observed with the first application. In the fourth year when no manures were applied the plots previously manured showed a disinct falling off in girth increase as compared with the unmanured plots.

In these experiments the manures only had a stimulating effect in the year of application, followed by a slight reaction. It will be interesting to learn to what extent the fertilisers have been profitable, as shown by the yields of latex during the present year.

SUGAR CROPS

523 – **Manurial Experiments on Sugar Cane, 1914-1915.** — VERTEUIL, J. DE (Superintendent of Field Experiments) in *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XIV, Part 5, pp. 145-155. Trinidad, 1915.

Each experiment was made on eight equal plots similarly treated, so that the result given for each plot is the mean of eight experiments and refers to the first ratoon crop.

The manures applied were as follows :

| | Plant canes per acre | First ratoons per acre |
|---|---|---|
| *Plot* 1. | Complete manure:<br>45 lb. nitrogen as calcium nitrate.<br>40 " phosphates as dissolved bones.<br>28 " potash as sulphate of potash. | 45 lb. nitrogen as calcium nitrate. |
| *Plot* 2. | Complete manure: as above but N. from sodium nitrate. | 45 lb. nitrogen as sodium nitrate. |
| *Plot* 3. | Complete manure: as above but N. from calcium cyanamide. | 45 lb. nitrogen as calcium cyanamide. |
| *Plot* 4. | Complete manure: as above, but N. from sulphate of ammonia. | 45 lb. nitrogen as sulphate of ammonia. |
| *Plot* 5. | Complete manure:<br>45 lb. nitrogen as sulphate of ammonia.<br>40 lb. phosphates as dissolved bones. | ditto |
| *Plot* 6. | 45 lb. nitrogen as sulphate of ammonia<br>40 lb. potash as sulphate of potash. | ditto |
| *Plot* 7. | 45 lb. nitrogen as sulphate of ammonia. | ditto |
| *Plot* 8. | Control. — no manure. | Control. — no manure. |

The rainfall during the year was 53.82, 51.51 and 63.43 inches for the three estates on which the experiments were carried out. The manures

*Summary of Results of Manurial Experiments.*

| Plot. | Brechin Castle Estate. | | | | Esperanza Estate. | | | | Malgretoute Estate. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Manures complete applied to Plant canes and First Ratoons. | | Nitrogenous manures to First Ratoons. | | Nitrogenous manures to First Ratoons only. | | Average of Plant canes and First Ratoons. | | Nitrogenous manures to First Ratoons. | | Average of Plant canes and First Ratoons. | |
| | Yield of Canes. | Increase or decrease on control. | Yield of Canes. | Increase or decrease. | Yield. | Increase or decrease. | Yield. | Increase or decrease. | Yield. | Increase or decrease. | Yield. | Increase or decrease. |
| | tons. | tons. | tons. | tons. | tons | tons. | tons. | tons. | tons. | tons. | tons. | tons. |
| 1 | 39.89 | + 2.51 | 40.97 | + 3.59 | 31.44 | + 8.56 | 27.75 | + 7.85 | 20.03 | + 0.07 | 22.28 | + 1.70 |
| 2 | 43.03 | + 5.65 | 41.76 | + 4.38 | 31.78 | + 8.90 | 26.78 | + 6.88 | 22.54 | + 2.58 | 23.94 | + 2.36 |
| 3 | 38.90 | + 1.52 | 40.48 | + 3.10 | 29.06 | + 6.18 | 24.63 | + 4.73 | 24.00 | + 4.04 | 23.87 | + 2.29 |
| 4 | 42.54 | + 5.16 | 42.93 | + 5.55 | 30.42 | + 7.54 | 24.06 | + 4.16 | 22.82 | + 2.86 | 23.29 | + 1.71 |
| 5 | 45.00 | + 7.62 | 41.36 | + 3.98 | 29.74 | + 6.86 | 23.83 | + 3.93 | 22.91 | + 2.95 | 20.37 | — 1.21 |
| 6 | 38.61 | + 1.23 | 44.41 | + 7.03 | 28.83 | + 5.95 | 22.58 | + 2.68 | 21.90 | + 1.94 | 21.89 | + 0.31 |
| 7 | 39.94 | + 2.56 | 39.94 | + 2.56 | 28.83 | + 5.95 | 23.15 | + 3.25 | 19.64 | — 0.32 | 20.63 | — 0.95 |
| 8 (no manure) | 37.38 | — | 37.38 | — | 22.88 | — | 19.90 | — | 19.96 | — | 21.58 | — |

were applied in June 1914 and July 1914, while the canes were harvested in March, April and June 1915.

The value of the canes was calculated on a basis of 10/- and 12/6 per ton. At the former price several plots show a loss, whereas these same plots show a profit when valued at the higher price.

In one series, the mixed manures were applied to both plant canes and ratoons but without any obvious benefit, better results being obtained from the plots only having applications of single manures applied to the ratoon crop.

The plots receiving sulphate of ammonia were, as a rule, unsatisfactory. The general indications of these results are that nitrate nitrogen is more efficient than ammonia or cyanamide and that sodium nitrate is superior to calcium nitrate when applied alone to ratoons, but inferior in a complete manure.

Ammonium salts are profitable when applied in conjunction with phosphates and potash or with phosphates alone, but not when applied with potash alone.

HORTICULTURE

524 – **The Acclimatisation of Plants and Their Adaptation to the Soil by Grafting.** – DENTAL, J. B. in *Revue horticole*, Year 88, No. 3, pp. 47-49. Paris, March 16, 1916.

By means of grafting new horticultural species upon others that are hardy, or already acclimatised, it has often been possible to introduce the former where the soil is not suited to their requirements. Thus while about 20 years ago, the cultivation of *Acacia dealbata* was a monopoly of the Cannes districts (where the soil consists of granite and mica-schists) and this plant did not grow well in the rest of the Côte d'Azur (where the soil is more or less calcareous) this variety of *Acacia* can now practically be grown throughout the latter region, if it is grafted on A. *floribunda*. The latter has also been adopted as a stock for *A. podalyriaefolia, A. Baileyana, A. decurrens, A. pubescens*, and their varieties. From the economic point of view, the cultivation of all these acacias has become most important.

On the basis of these principles, the writer has made some experiments in adaptation by grafting ; the following gave him complete satisfaction ;

1) *Macadamia ternata, Hackea eucalyptoides* and *H. pinifolia* on *Grevillia robusta*. The last species is a valuable stock on which are usualy grafted ; *Grevillia asplenifolia — G. Preissii — G. Banksii — G. Hillii — G. Drummondii — G. rosmarinifolia — G. alpestris — G. macrostylis* — and *G. sulfurea* ; it does well on calcareous soils, except when these are damp and undrained.

2) *Araucaria Bidvillii* on *A. excelsa*.

3) *Ficus Roxborghii* and *F. australis variegata* on *F. rubiginosa*.

4) *Raphiolepis Delacourii* on *Cydonia vulgaris*.

3) *Raphiolepis indica* on *Eriobotrya japonica*.

6) *Callitris australis* (calciphobe) as well as *Juniperus pachyphlae* and its varieties : *conspicua, ericoides, elegantissima*, on *Cypressus pyramidalis*.

7) *Tacsonia* on *Passiflora caerula*, and still better, on *P. floribunda*.

8) *Bouganvillea brasiliensis* on *B. Sanderiana*.

Grafting *Cactaceae* on certain species of the same genus produces rot of the collar.

Species of *Iris* possessing rhizomes can be grafted on one another, for example, *Iris germanica* on *I. pallida*. A fact worthy of note is, that while these grafts have succeeded in the case of different species, the grafting of nearly related plants such as that of *Eucalytpus ficifolia* on *E. globulus*, *E. polyanthema* and *E. cosmophylla* gave negative results.

525 - **The Blooming Season, Ripening Dates and Length of Season for Hardy Fruits.** — HEDRICK U. P. in *New York Agricultural Experiment Station Geneva* N. Y. *Bulletin* Nos. 407 and 408, pp. 367-391, 392-418. Geneva, June 1915. FRUIT GROWING

I. — *The Blooming Season of Hardy Fruits.* — The above mentioned bulletin indicates a blooming season from observations extending over many years at the New York Agricultural Experiment Station, Geneva, for all the varieties of fruits commonly cultivated in the State of New York.

This list allows : 1) the elimination of early-blooming varieties where spring frosts are to be feared ; 2) the interplanting for cross-pollination of varieties blooming at the same time : 3) the determination of the date of spraying ; 4) the selection of varieties blooming at different times when it is desirable to prolong the spraying season.

A considerable amount of work in cross-pollination at this Station has led to the general observation that very warm weather leads to a more rapid development of the stamen than of the pistil. Not infrequently, in excessively hot weather, it will be found that the stamens have developed much more rapidly than the pistils — that the anthers have burst and lost their pollen before the stigmas are receptive. On the other hand, the stamens develop least rapidly in cold weather. This perhaps explains why, even when the trees blossom well, there is uncertainty as regards the setting of the fruits. Rain during blossoming time is a frequent cause of a poor setting of fruit as it causes the pollen grains of practically all fruit trees to swell and burst. The writer gives as typical blooming dates those he observed in 1912 (an average year). These dates correspond very nearly to the average blooming dates observed in the other years. The typical dates of the beginning of the blooming season, its duration (the interval between the appearance of the first and the last flowers) and the numbers of varieties of each species mentioned in the bulletin in question, are set forth in the accompanying table. In this list, the blooming season of each variety is distinguished as: very early, — early — mid-season, — late — very late.

II. — *Ripening Dates and Length of Season for Hardy Fruits.* — The observations on this subject refer to the same varieties of fruits as those dealt with in the preceding paper and to the same years. It has thus been possible to solve the question as to the existence of a correlation between blooming time and ripening time ; the answer is negative. The date of maturity is given in the case of each kind of fruit, and the number of weeks the fruits can be kept in the common storage.

The Station where these observations were made is in N. latitude 42° 52' 46" ; the altitude is from 500 to 525 feet above sea-level. The

| | Date of blooming. | Duration of blooming in days. | Number of varieties selected. |
|---|---|---|---|
| Cherries | May 1 | 6 | 35 |
| Pears | » 2 | 10 | 102 |
| *Prunus domesticus* | » 3 | | 80 |
| *P. insititia* | » 3 | 10 | 11 |
| *P. cerasifera* | » 3 | | 11 |
| *P. triflora* | » 3 | 4 – 8 | 14 |
| Hybrid Plums | » 3 | 7 | 14 |
| Currants | » 3 | 8 | 30 |
| Apples | » 4 | 12 | 347 |
| Sour cherries | » 4 | 8 | 28 |
| Hybrid cherries | » 4 | 8 | 9 |
| Gooseberries | » 4 | 10 | 59 |
| Peaches | » 5 | 10 | 248 |
| Crab apples | » 6 | 8 – 10 | 22 |
| *Prunus Munsoniana* | » 7 | | 5 |
| *P. americana* | » 7 | | 6 |
| *P. hortulana* | » 7 | 6 | 3 |
| *P. hortulana Mineri* | » 7 | | 3 |
| *P. americana mollis* | » 7 | | 1 |
| Strawberries | » 16 | 17 | 137 |
| Blackberries | » 31 | 24 | 23 |
| Black raspberries | » 31 | 7 | 19 |
| Red raspberries | June 1 | | |
| Hybrid raspberries | » 7 | 14 | 28 |
| Yellow raspberries | » 11 | | |
| Grapes | » 14 | 20 | 230 |

land lies about 1 mile from Seneca lake and the soil is a cold heavy clay. The proximity of the lake and the coldness of the soil no doubt delay the ripening time by several days.

526 – **Dwarf Apples.** — HEDRICK U. P., *New York Agricultural Experiment Station, Geneva N. Y., Bulletin* N. 406, pp. 341-368. Geneva, N. Y. May 1915.

At the request of the horticultural societies of the State, the New York Agricultural Experiment Station of Geneva undertook a comparative test of dwarf and standard apple trees. This bulletin is a final report of the test, which was carried on for ten years.

For the standard trees, French Crab stock were used, and for the dwarfs, Doucin and French Paradise stock.

Sites for the tests were selected with reference to climate and soil in three widely separated parts of the State as follows: Kinderhook, Columbia County, in the Hudson Valley; Fayetteville, Onondaga County, in Central New York; and Carlton, Orleans County, on the shores of Lake Ontario, in western New York.

The general plan of the test was to grow a permanent orchard of standard trees with fillers on Doucin stock and between these, trees on Paradise stock. The orchards were set with 27 varieties represented by 1 193 trees; 114 were on French Crab, 424 on Doucin and 655 on Paradise stocks.

The care taken of the orchards was that commonly given commercial orchards in New York except in the matter of pruning. Summer pruning is part of the recognized early treatment of dwarf trees. In this ten years' test no satisfactory time nor method could be found to prune these trees which did not promote a weak, sickly growth. The branches invariably died back the next winter.

The results show:

1. That the union between stock and scion is poorer with Doucin and French Paradise stocks that with the French Crab, and that varieties unite less well on French Paradise than on Doucin stocks.

2. Doucin and French Paradise stocks are less hardy than French Crab, and of the two dwarfs French Paradise is much less hardy.

3. The greatest weakness of the dwarfing stock for New York is the surface-rooting habit, in which character the two stocks cannot be distinguished. Evil results following surface rooting are winter-killing, uprooting of trees by wind, suckering and injury in cultivation.

4. Suckers from both dwarfing stocks proved much more troublesome than with the standard trees.

5. The trees on the three stocks attain the size commonly ascribed to them; those on French Crab are full-sized; on Doucin, half dwarf; on French Paradise, true dwarfs. In this test the dwarfing effect of the dwarf stock was not as marked as is commonly reputed. The writer concludes that distances apart commonly recommended for dwarf trees bring them much too close; in New York, Doucins should be set half, and the true dwarfs one-third, as far apart as standard trees. That is, apples on Paradise should be planted from 15 to 18 ft. apart; on Doucin 20 to 25 ft. apart. If the scion is permitted to strike root, greater distances must be allowed.

6. Trees on French Paradise come in bearing soonest, Doucin next and French Crab last. The differences in time of bearing would not be very material in commercial orchards.

7. The test has not been such that a safe conclusion can be drawn as to which stock makes the most productive orchard.

8. There were no marked differences in size, colour and quality of the apples of the three stocks.

9. The advantages of dwarf trees appeal to amateur rather than professional apple growers. Thus, the trees take less space and therefore permit a greater variety in orchard or garden and they are more handsome ornamentals.

VINE GROWING. 527 – **Experiments in Manuring Vines with Chemical Fertilisers, Carried out in 1915 by the National Society of Agriculturists of Hungary.** — Kovácsy B., in: I. *Mezögazdasági Szemle*, Year XXXIV, No. 2, pp. 66-69, 4 Illustr. Budapest, February 1916 — II. *Die Ernährung der Pflanze*, Year XII, No. 5, pp. 37-39. Berlin, March 1, 1916.

In spite of the large amount of damage (due to frost, mildew and hail), done to the vines during the last 3 years, the National Society of the Agriculturists of Hungary continued in 1915, their manurial experiments upon the vines of the different vinegrowing districts of the country. In this work they were assisted by 18 proprietors of vineyards. The results, however, which are summarised in the following table, only represent the data obtained by 10 vine-growers, for the 8 others were unable to finish their experiments on account of unfavourable weather conditions. The experiments were made on the most characteristic soils of the country (namely those of the mountainous zones, and on the sandy soils) in the districts of Pest-Nográd — Ménes-Magyarád — Gyöngyös-Visonta — the Alföld — Villány — Pecs — Tokaj — Küküllö — Badacsony — Neszmély. In order to decide upon the amounts of chemical fertilisers to be used, the observations of the Royal Hungarian Vine-growing Institute were taken as a basis, according to which a large increase in the yield could only be obtained by using larger quantities than had hitherto been employed. Thus, 465 lbs. of superphosphate, 155 lbs. of 40 per cent potassic salt and 231 lbs. of sulphate of ammonia were applied per acre.

On examining the results, it is seen that No. 5 gave the maximum returns, which is the more surprising since this vineyard received no sulphate of ammonia. The higher yields must be attributed to more careful cultural operations, and to the fact that the vineyard of Pécs being situated at the foot of a hill and having a soil which is rich in humus and nitrogen, does not require nitrogenous fertilisers. The fertilisers have a great effect upon sugar formation, in fact all the manured vineyards had a higher sugar percentage than the control plots. The increase in the sugar content due to the use of the fertilisers was from 1 to 3 per cent.

The following conclusions can be drawn :

1) Chemical fertilisers considerably increase the yield, even on heavy soils, provided the vineyards are not injured by bad weather or the attacks of various pests.

2) In vineyards situated on various soils, even in very heavy ones, the 3 fertilisers should be applied in very large quantities, as the amounts hitherto used of from 154 to 309 lbs. per acre, are unable to penetrate to the deeply-seated roots, and thus it is not possible for the fertilisers to produce an increase in the yield. An exclusively phosphorus-nitrogenous fertiliser does not give the best result, which can only be obtained by the help of all three fertilising compounds.

3) The fertilisers should be dug in very deep, the phosphatic and the potassic fertilisers being applied together in the autumn if possible, and the nitrogenous fertiliser in the spring.

4) Chemical fertilisers gave the best results from the first year of their use in those vineyards which had previously received a liberal amount of stable manure. In such vineyards, there is a strong development of

## *Results of Manurial Experiments.*

| Number | Vineyards | Nature of soil | Age of vines (years) | No. of vines per acre | Vines | Amount of Fertilisers Used, lbs. per acre | | | Percentage of Sugar | | Yield of must, gallons per acre | | | Value of Increase, per acre | Cost of manure | Profit due to manure | Value per gall. of must |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Super-phosphate | Salts of Potassium | Sulphate of ammonia | With manure | Without manure | With manure | Without manure | In-crease | | | | |
| | | | | | | | | | | | | | | £ s d | £ s d | £ s d | s d |
| 1 | Pencz. . . . | compact clay | 6 | 3 376 | Ezerjó. . | 466 | 155 | 232 | 18 | 16 | 276.99 | 151.35 | 124.64 | 14 3 3 | 3 2 5 | 11 3 5 | 2 3 |
| 2 | Ópálos . . . | dioritic . . . | 15 | 2 954 | various . | 466 | 155 | 232 | 20 | 19 | 186.96 | 124.64 | 62.32 | 7 1 8 | 3 11 2 | 3 10 6 | 2 3 |
| 3 | Gyöngyös. . | humiferous . | 10 | 2 672 | Ezerjó. . | 466 | 155 | — | 16 | 13 | 1086.16 | 997.13 | 89.03 | 10 2 4 | 1 7 4 | 8 15 0 | 2 3 |
| 4 | Nyiregz Láza | sandy . . . | 14 | 3 868 | Riesling . | 466 | 155 | — | 18 | 18 | 569.79 | 551.98 | 17.80 | 2 0 6 | 1 7 4 | 0 8 5 | 2 3 |
| 5 | Pécs . . . . | clay . . . . | 16 | 3 868 | Furmint . | 535 | 232 | — | 21 | 18 | 1112.87 | 265.65 | 347.21 | 78 18 4 | 1 2 8 | 77 7 4 | 4 6½ |
| 6 | Tarczal . . . | compact clay | 16 | 4 219 | Furmint . | 466 | 155 | — | 24 | 24 | 186.96 | 151.35 | 35.61 | 6 16 0 | 1 7 4 | 5 7 2 | 3 9½ |
| 7 | Almádi . . . | compact clay | 18 | 3 727 | Riesling . | 466 | 155 | 232 | 19 | 16 | 970.82 | 836.88 | 133.54 | 15 3 6 | 3 11 2 | 11 12 4 | 2 3 |
| 8 | Csóka. . . . | clay . . . . | 7 | 5 626 | Ezerjó. . | 466 | 155 | — | 18 | 18 | 970.82 | 738.94 | 231.47 | 26 6 1 | 1 7 4 | 41 12 2 | 2 3 |
| 9 | Mór . . . . | clay . . . . | 10 | 5 626 | — | 466 | 155 | 232 | 19.5 | 18 | 382.82 | 231.47 | 151.35 | 17 4 0 | 3 11 2 | 13 12 10 | 2 3 |
| 10 | Ádámos. . . | clay . . . | 7 | 2 813 | various . | 466 | 155 | 232 | — | — | 623 21 | 311.60 | 311.60 | 35 8 3 | 3 11 2 | 31 17 1 | 2 3 |

vigorous roots ; in vineyards with superficial, weak and exhausted roots, the fertilising effect of the chemical manures only shows itself after the repeated application of the fertilisers, that is to say, not until the roots have regained their strength.

5) Chemical fertilisers hasten the ripening of the grapes, and increase their sugar content.

528 - **Hybrid Direct Bearers in the Plain of Pisa, Italy.** — RACAH VITTORIO, in *l'Italia agricola*, Year 53, No. 3, pp. 122-128, 4 figs., Piacenza, March 15, 1916.

The writer first mentions the origin of hybrid direct bearers, the works on crossing and the ideas they inspired, subsequently describing the best hybrid direct bearers which he has seen in the vineyards of Sig. Serlupi (San Frediano a Settimo, plain of Pisa), where there is a collection of over 200 hybrids and where 20 are grown on a large scale. Of these, the following appeared the best ;

Seibel ; 1, 2, 47, 60, 128, 405, 857, 1000, 1077 ; 28-56 — Castel 114-120 — Couderc 7120, 106-46, 272-60 — Gaillard 2.

The writer advises the use of the following : for long pruning : Seibel 405 1000, 1077 — Gaillard 2. For growing short, with close or mixed pruning : Couderc 7120, 106-46 — Seibel, 1 and 2.

In localities that are damp and subject to fogs, very subject to fungoid disease : *a*) with black grapes : Seibel 1, 2, 47 1077 — Gaillard 2 — *b*) with white grapes : Seibel 857 — Castel 114 — Couderc 272-60 — *c*) with rose-coloured grapes : Seibel 28-59.

The writer is of opinion that in damp, deep, fertile soils (e. g. in Tuscany, those of Pisa, Valdichiana, and Val d'Arno ; in N. Italy, those of the plain of Padua, where vines are grown producing heavy crops and giving wines usually possessing little colour, and of low alcohol content), the quality of the wine would undoubtedly be greatly improved by substituting, if only partially, 1 or 2 good varieties of hybrids for the vines producing grapes of inferior quality.

529 - **Hybrid Direct Bearers in Friuli, Italy.** — COCEANI, B., in *Bollettino dell'Associazione agraria friulana*, Year 6, Series VII, Vol. 31, Nos. 1-12, pp. 168-178. Udine, December 1915.

Observations made in the experiment vineyard of the Friulian Antiphylloxera Consortium of Gagliano (Comune of Cividale, Province of Udine) on average soil, with gravel subsoil, and situated in a dry, open district. These conditions are those usually obtaining in the vineyards of the Friuli plain. The soil of the vineyard which was the subject of the experiment contained 7. 2 per cent of lime ; the vineyard was composed of the following 63 vines coming from State nurseries in the Tremiti islands :

Alicante Ganzin — Alicante Terras No. 20 — Auxerrois Rupestris — Castel 120, 1028, 3915, 3917, 4233, 4327, 5009, 6011, 6030, 6228, 6606, 7214, 9137, 10916, 13317, 13320, 17033, 17227, 19403, 20418 — Couderc 28-112, 44-01, 71-06, 71-20, 71-46, 74-17, 82-12, 82-32, 83-3, 93-5, 96-32, 101, 106-46, 124-20, 132-11, 146-51, 198-21, 199-88, 202-137, 226-21, 252-14, 267-27, 272-60, 343-14, 503, 1305, 3907, 4308 — Fournié, — Jouffreau — Jurie 580 — Seibel 1, 2, 128, 156, 417, 857, 2007 — Gaillard 2, 157.

Almost all the vines did well that were planted out after growing for one year in the nursery, ; others took root with much difficulty, namely : Alicante Ganzin, Couderc 124-120, 198-21, 226-21. Most of them grew luxuriantly ; some were of average development (Alicante Ganzin — Auxerrois Rupestris — Castel 3915, 3917, 6011, 9137, 1320 — Couderc 82-12, 82-32, 202-137, 343-14 ; a small number were poorly developed (Castel 4233, 4327, 19403 — Couderc 199-88, 226-21, 252-14).

In the case of each vine, the writer gives the quality of the grapes and the degree of the plant's resistance to fungoid disease and to phylloxera. He divides the vines into three classes as regards resistance to mildew.

1) Immune *i. e.* not requiring to be sprayed.

2) With signs of mildew which are not of a serious nature but can be controlled by one spraying in normal years, and with 2 in years when mildew is especially prevalent.

3) Vines as subject to the disease as the ordinary European varieties, and therefore to be eliminated.

Few vines belong to the 1st class, these are :

Alicante Terras 20 — Castel 1028, 4233, 5009, 17033 — Couderc 198-121 and 4308 — Fournié.

The following belong to the 2nd class :

Castel 120, 3915, 3917, 4327, 6011, 6228, 7214, 10916, 13317, 13320, 17227 — Couderc 28-112, 93-5, 96-32, 101, 132-11, 146-51, 267-27, 272-60, 1305, 3907, — Jouffreau — Jurie 580 — Seibel 1 — Couderc 503 — Gaillard 2.

Of the vines of these two classes, the Castels 4233 and 4327 and Couderc 93-5 have not yet borne grapes, therefore they cannot be judged from the point of view of their produce. Castel 17033 and Couderc 28-112 had phylloxera galls on their leaves. Castel 6228 and 7214, and Fournié had a pronounced foxy flavour. Castel 3915 and 3917, and Couderc 1305 ripen too late; they therefore never attain complete maturity, and are subject to the danger of the autumn rains. Castel 13317 suffers from the defect of having a large number of green grapes when it is ripe. Couderc 146-51 is more a table grape, but it has not the requisite qualities, Finally, Castel 5009 (which has a " herby " taste) 10916 (which has a similar flavour), 17227 ; the Couderes 96-32, 101, 132-11, 198-21, 4308 (also with a « herby » flavour), 503 (which ripens irregularly) ; Jouffreau ; Jurie 580 ; Seibel 1 ; Gaillard 2 beas black grapes which are too dark to find favour in Friuli, where no wines for blending are made. After having made a selection from all these vines, there only remain 9 out of the 34 of the 2 first classes ; 6 with black grapes : Alicante Terras 20 — Castel 120, 13320, 17227 — Couderc 267-27, 3907; — 3 with white grapes : Castel 1028, 6011 — Couderc 272-60) which at present are the best that have been tested. It is, however, quite possible that further observations may modify or complete this judgment.

## LIVE STOCK AND BREEDING.

HYGIENE

530 – **The Experimental Control of Distomatosis in Hungary.** — MARCH J. in *Allatorvosi Lapok* (Veterinary Journal). Year XXXIX, Nos. 1-2-3, pp. 1-6 ; 11-14 ; 17-24. Budapest, January 1-8-15, 1916.

During the summer of 1913, numerous contagious diseases appeared in Hungary, distomatosis especially, causing serious losses. This fact, as well as the publications of RALLIET, MOUSSU and HENRY on the control of this disease, by means of fern extract, have encouraged the writer to make an extensive study of distomatosis and to experiment with curative methods on 65 head of cattle and on 87 head of sheep. Up to date only the experiments with sheep have been completed. The affected animals were periodically examined by the writer and then killed in the public slaughterhouse of Budapest to allow of a microscopical and macroscopical examination of the liver and related organs. So far few animals have died during the experiments.

The anatomical changes in the liver corresponded to those already described, except in cases of very numerous invasion, when they were more severe in cattle than in sheep Another characteristic anomaly which has seldom been noticed before was the following : the left lobe of the liver, both in cattle and sheep, was more seriously affected than the right lobe, showing the greater number of flukes. In some milder cases of distomatosis, only the left lobe of the liver contained distoma ; as a possible explanation of this fact the suggestion is made that this side of the liver might be more easily accessible to the parasites than the other.

In one cow and three sheep, there were found, together with medium sized distoma, some flukes measuring from 10 to 15 mm. in length, full of eggs, and others measuring from 5 to 10 mm. in length without eggs.

The number of parasites found in 20 head of cattle which had not been treated with curative remedies, ranged from 116 to 1660.

The greater number of the parasites belonged to the species *Distoma hepaticum*, and only a few to *D. lanceolatum*, which was always to be found in conjunction with the former. In one exceptional case a single sheep showed no less than 888 parasites of the latter type. It has not been ascertained as yet whether the number of *D. lanceolatum* increases in proportion to that of *D. hepaticum*, but this is very likely the case. In animals affected by distomatosis an alteration of the bile was always to be noticed ; the liquid part being thicker, mucilaginous and of a dirty greenish-brown colour ; the solid part being composed of eggs of distoma. The gall bladder was enlarged. The external symptoms of the disease have been noticed only in animals showing at least 250 parasites for cattle, and 100 for sheep. Thus these symptoms only appear when the animals' blood is infested by the flukes to such an extent as to cause emaciation and anæmia in the host. Only one case of dropsy occurred, in a cow. The size of the liver was found abnormally large in 29 head of cattle while in sheep it was always normal.

The diseased cattle rarely suffered from intestinal troubles, but often showed a rise in temperature. The number of fluke eggs in the fæces varied with the consistency of the fæces ; it was small in cases of diarrhœa when the rapid widing of the excrement hindered their accumulation, and much larger after fasting owing to the longer retention of the excrement in the intestine. The faeces of the cows generally contained a smaller number of eggs than the ovine faeces . The number of eggs of *D. lanceolatum* in the faeces varied between much wider limits than the number of eggs of *D. hepaticum.*

The writer discusses the results of the experiments made by MOUSSU, BLANCHARD, VIASZ, MOLPHETAS and others, subsequently describing his own experiments. His first trials with fern extract date from 1912, and were followed by similar experiments with Kamala, and other preparations of the same kind. The experiments on sheep, the only ones completed up to date, gave the following results :

It is possible to control distomatosis in sheep with success by curative methods, especially if the disease has not reached the stage of deep pathological changes of the liver. Medium strong doses of Kamala give 85 % of recovery in sheep, while in the remaining 15 % the flukes are checked to such an extent that the life of the host is not endangered. The best results are obtained with Kamala. A preparation containing this substance, called " parasitine ", is less effective, though the results are fairly good. The preparation called " calbazene " contains too little Kamala to be really effective.

For one year old sheep 15 gms. of Kamala in 2 doses with 6 to 12 hours intervals are required. To strong animals the whole dose may even be given at one time, but in the case of weak animals, or those suffering from diarrhœa, the dose should be increased to 20 gms. and given at 5 intervals. " Parasitine " is administered at the rate of 2 pills in $^1/_2$ or 1 day intervals.

After taking Kamala the sheep appear to be sick for 3 to 5 days ; they lie down, eat little or nothing, and suffer from diarrhœa ; no other symptoms of the disease are to be seen. Under the influence of Kamala, the flukes die in about 3 to 8 days and are expelled from the bile into the intestine.

The eggs resist the action of Kamala much longer, but in about 8 days they are killed and expelled. The expense of the Kamala treatment is insignificant.

Fern extract (including " fascioline ") has been found inefficient as it only destroys, in sheep, one half of the flukes. This failure is due to the varying content of active substances in the ferns according to their habitat, and to the methods used for making the extract. The high toxicity of this extract, which prevents its use for a sufficient length of time, must also be considered. It should therefore only be used when Kamala is not available, and when the extract is known to be sufficiently strong, though even then the results are not certain.

The dose of fern extract for yearlings is 5 gms. and for older animals

6 gms. ; it should be spread over 6 consecutive days, mixed with a double quantity of neutral oil.

The fern extract is quite inefficient with cattle, but a dose of a 5% solution of "filmaron" may kill some of the flukes if injected periodically. This process, however, is not to be recommended in practice for the results are rather uncertain, the liquid soon losing its properties.

The excellent results obtained with Kamala on sheep lead to the supposition that it will be equally effective for cattle. The results obtained by the writer apply only to *D. hepaticum* since *D. lanceolatum* was not killed by these methods of control. This is, however, of little consequence because the latter is found only in small numbers and only causes a mild and less dangerous form of distomatosis.

Should the writer's experiments prove that Kamala also destroys the parasites of the liver of cattle it would be possible in future to diminish the cases of disease occurring in animals out at pasture . For such an object the following method should be adopted : all the animals (sheep and cattle) should be treated with Kamala at the beginning of the winter ; for the two succeeding weeks the dung should be collected and covered with dung from healthy animals in order to kill the fluke ova by the process of decomposition. This should be repeated in the spring just before taking the animals to pasture, so as to kill the few distoma that may have survived the first treatment. If during the pasturing time, cases of distomatosis occur, the diseased animals should be isolated and again submitted to the medicinal treatment. Newly bought animals should also be immediately treated with Kamala unless they are positively known to be free from distomatosis.

531 – **Treatment of Navel-Ill by means of Serum derived from the Blood of the Mare.** — Forssell Gerhardt, in *Berliner Tierärztlicher Wochenschrift*, Year XXXII, No. 12, pp. 133-135. Berlin, March 25, 1916.

The ætiology of navell-ill in foals has been discussed for a long time. Some veterinary surgeons consider that the infection of the foal from the navel takes place after birth, while others believe it is ante-natal. The writer inclines to the latter hypothesis, from the two following facts : 1) that foals, apparently healthy at the moment of birth, may fall sick some days or even weeks later : 2) that in the mother no symptoms of the disease are ever seen. The writer has concluded that the blood of the mare must contain certain specific substances which preserve her from the disease and which are also communicated to the fœtus. After birth, when these substances can no longer be transmitted to the foal though the common capillaries, the foal is liable to contract the disease because these specific substances can no longer prevent the disease.

These considerations have suggested to the writer the possibility of curing sick foals by injecting the moment the malady appears, a certain quantity of serum taken from the mother's blood. With this object, he has devised a method of treatment which has been published in the *Swedish Veterinary Review*, 1915, No. 5 ; and was tested in 1915 by several veterinary surgeons on 8 sick foals, 4 of which were cured. Of the other 4 unsuccessful

cases, 2 may have been due to the fact that the treatment was applied only 5 and 14 days, respectively, after the disease appeared.

*Method of treatment:* The blood is drawn by means of a cannula designed by the writer which is sold by Messrs. Jacoby of Stockholm; it is collected in a sterilized glass vessel and after standing a few hours the serum is separated from the solids. From 2 to 2.5 litres of blood should be drawn so as to obtain a sufficient quantity of serum. The injection is made either hypodermically or endovenously in doses of from 200 to 300 cc. per foal; or 200 cc. may be injected hypodermically and 150 cc. endovenously at the same time. If the quantity of serum is sufficient, the operation may be repeated after a few days. The injection should be performed immediately the first symptoms of the disease appear. It may be possible to prevent the disease by giving the injections as soon as the foal is born, even if no symptoms are visible.

532 – **Modification of Theiler's Method for the Immunisation of Cattle agains Piroplasmosis.** — SÁ CARLOS and CUNHA ALMEIDA in *Revista de Veterinaria e Zootechnia*, Year V, No. 6, pp. 228-303, 4 Pl., Rio de Janeiro, December 1915.

A summary of the work done up to the present time on "tristeza" (bovine piroplasmosis or babesiosis) in Brazil, and an account of the immunisation experiments and observations made by the writers, followed by a bibliography of 25 works.

As a result of their clinical experience, the writers conclude that the tardy injection of trypan-blue by Theiler's method for immunisation against "tristeza", seriously endangers the animals' lives, while early injection of the remedy avoids this danger without detriment to the immunisation process. An early injection of trypan-blue is always preferable to a late one and should be made at the beginning of the first sign of fever caused by the reaction, *i.e.* as soon as the initial temperature has risen 1° C. By this means even animals of more than 2 years old can be rendered immune without danger.

533 – **Plague Attacking Wild Ducks in Milan.** — COMINOTTI LUIGI (Station for the experimental study of infectious diseases of cattle, Milan) in *La Clinica veterinaria*, Year XXXIX, No. 5, pp. 129-135, 2 Figs. Milan, March 15 1916.

Ducks are fairly immune to bird-plague under normal conditions. In practice this immunity constitutes a valuable diagnostic character which serves to distinguish cholera and plague in the case of infection breaking out and spreading rapidly in a poultry farm. Sometime ago, some wild duck in a section of the lake in the Milan public gardens were attacked, aud half their number killed. The writer believes this infection may have been due partly to an exceptional virulence of the virus of the disease (which, as several writers have proved, shows a marked variation in degree of virulence and resistance to disinfectants); and partly to the diminished disease resistance of the wild-duck when in captivity. From the study of the infection the writer draws the following conclusions:

1) Bird-plague may attack even wild duck when in the same conditions as domestic fowls.

2) The clinical form taken by the plague infection in these birds is the nervous form.

3) The post-mortem examination revealed no pathological peculiarities.

4) The virus, as is also the case with geese, is not present in advanced infection, either in the blood or the internal organs, but is found instead in the central nervous system.

5) The infection can be transmitted to fowls by the subcutaneous inoculation of an emulsion of brains from infected ducks ; in the case of domestic ducks, on the contrary, it is not possible to induce infection (however great the quantity of virus) either by ingestion, endovenous inoculation, injection in the membrane of the eye or endocerebral inoculation.

CATTLE

534 – **Raising the Dairy Calf.** — WOODWARD, E. G. *The University of Nebraska, Bulletin of the Station of Nebraska*, Vol. XXVII, Article VI, Bulletin No. 149, pp. 1-16, 8 figs. Lincoln, Nebr. April 5, 1915.

TABLE I. — *Showing Results of Feeding Three-day Steer Calves Skim Milk up to the Age of One Year.*

| Calf | Age days | Whole milk lbs | Skim milk lbs | Alfalfa hay lbs | Grain lbs | Birth weight lbs | Final weight lbs | Daily gain lbs |
|---|---|---|---|---|---|---|---|---|
| Jersey . . . . . | 360 | 258 | 5 958 | 1 609 | 1 178 | 60* | 580 | 1.44 |
| Holstein-Jersey. . . . . | 384 | 251* | 6 366 | 1 696 | 1 652 | 48 | 750 | 1.83 |
| Grade Holstein . . . . . | 344 | 245 | 5 620 | 1 584 | 1 238 | 74 | 700 | 1.82 |

* Estimated.

TABLE II. — *Showing Feed Requirement to raise a Calf up to the Age of Six Months when Skim Milk is used.*

| Feed | Amount lbs | Price | Value |
|---|---|---|---|
| Whole milk . . . . . | 175 | per cental $ 1.50 s. | $ 2.63 |
| Skim milk . . . . . | 2 700 | " " 0.25 s. | " 6.75 |
| Grain. . . . . | 125 | " " 1.00 s. | " 1.25 |
| Hay . . . . . | 450 | per ton "10.00 | " 2.25 |
| | | | $18.88 |

TABLE III. — *Showing the Feed Requirement to raise a Calf up to the Age of Six Months when a Small Amount of Whole Milk is used.*

| Feed | Amount lbs | Price | Value |
|---|---|---|---|
| Whole milk . . . . . | 900 | per cental $ 1.50 | $13,50 |
| Grain . . . . . | 250 | " " 1.00 | " 2.50 |
| Hay . . . . . | 600 | per ton "10,00 | " 3.00 |
| | | | $19.00 |

*Rations for Heifers from 6 to 12 Months Old.* *Ration* I. — About 2 lbs daily of a mixture of 75 lbs corn chop and 25 lbs bran; all the alfalfa hay the heifer can eat.

*Ration* II. — 6 to 10 lbs silage; about 2 lbs daily of a mixture of 40 lbs corn chop (entire ground grain), 40 lbs linseed meal or cottonseed meal, and 20 lbs bran; all the alfalfa hay the heifer can eat.

*Rations for heifers One to Two Years Old.* *Ration* I. — About 3 lbs of corn daily; all the alfalfa hay the heifer can eat.

*Ration* III. — Corn silage, 12 to 20 lbs; about 3 lbs daily of a mixture of equal parts corn chop, bran and linseed meal or cottonseed meal; all the alfalfa hay the heifer can eat.

535 – **Effect of Small Quantities of Phosphates Fed to Cows on the Quantity and Quality of the Milk Produced** (1). — WALKER FRANK P. in *Report on Further Experimentation on the Feeding of Dairy Cows at Offerton Hall, Offerton Bulletin*, No. 5, pp. 14-21, Newcastle-on-Tyne, June 1915.

After the manuring of pasture lands with phosphatic manure, the quantity of milk and flesh of the cattle was so much increased that a trial was made in order to determine whether feeding of the cows with a substance rich in phosphate of lime would in any way influence the temperament and nervous system of the animals, and consequently the quantity and quality of their milk. — For this purpose to each of two groups of 5 cows (besides the usual ration, which was the same for all), 1 ounce of phosphate precipitate obtained from bone ashes was given from June 25 to July 30 (1912) to the first group; and from August 6 to September 10 to the second group. The bone ashes contained 70 % of phosphate of lime almost completely soluble in a 2 % solution of citric acid. From the results, the weekly averages of which are given in 9 tables, the following conclusions were drawn:

1) Feeding phosphate precipitate obtained from bone ashes produced no noticeable change in the quantity or quality of the milk. 2) The

(1) See No. 1193 *B.* Aug. 1912. (*Ed.*)

conditions of the cows showed nothing out of the normal that might be attributed to any stimulating effect caused by the phosphate they had received. 3) The slight effect produced on the quantity and quality of the milk was, if anything, depressing. 4) As regards live weight the cows that were fed with phosphate showed a tendency to increase in weight more rapidly than those that did not receive any phosphate.

536 - **Variations in Interval Between the Two Milking-times and their Influence on the Quantity and Quality of Milk.** — WALKER FRANK P. in *Report on further Experiments on the Feeding of Dairy Cows at Offerton Hall, Offerton Bulletin*, No. 5, pp. 5-13. Newcastle-upon-Tyne, June, 1915.

This experiment was carried out during the summer of 1911, with the purpose of determining the influence of a variation in the interval between two successive milkings on the quantity and quality of milk produced. From July 1 to August 11, the cows of one of the two groups under test were milked twice a day at equal intervals, that is at 6 in the morning and 6 in the afternoon. Those of the other group were also milked twice a day, but at intervals of 14 and 10 hours respectively, that is, at 6 in the morning and at 4 in the afternoon. Then, from August 1 to September 22, the cows of the first group were milked at unequal intervals and those of the second group at equal intervals. The food was exactly the same for both groups. Each day the quantity of milk was determined, as well as the fat content, and the solids not fat ; these were registered in a series of tables giving the weekly results per cow. The conclusions are : 1) It cannot be stated that the quantity and quality of milk is in any way influenced by the equal or unequal interval between the two daily milkings ; 2) The fat content varies considerably according to the length of the interval between the morning and evening milking ; 3) In order to ensure that the fat content of the milk drawn in the morning should be at least equal to that of the milk drawn in the evening, the interval between the two milkings should be as far as possible equal in length ; 4) In case of the percentage fat content being established by law for fresh milk sold on the market, the milk would have to be analysed for both milkings, in order to judge of the quality ; 5) While the fat content remains about normal in conditions of bad drought, the percentage of solids not-fat may, for those conditions, be sensibly diminished ; 6) The cows that were milked at equal intervals yielded more milk in the evening than in the morning. The evening milk was somewhat inferior in quality. The cows that were milked at irregular intervals yielded a richer milk in the evening than in the morning.

537 - **Maize Silage and Alfalfa Hay for Beef Production.** — BLISS R. K. and LEE C. B., *The University of Nebraska, Bulletin of the Agricultural Experiment Station of Nebraska, Bulletin* No. 151. 43 pp., 16 figs. Lincoln, Nebr., May 15, 1915.

The economy of silage in the ration of the dairy cow has been proved by many experiments in recent years. In the fattening of steers there are much fewer experimental data, some of which seem to be conflicting. The two experiments recorded in the present bulletin were inaugurated largely for the purpose of securing information on this subject. The first experi-

ment was carried on during the winter of 1912-13 with 48 head of two year-old steers of the Shorthorn and Hereford breeds; the second experiment was carried on during the winter of 1913-14 with 64 head of the same age and breeds as the steers used in the previous test.

*Rations used: 1st experiment.*

Lot 1. — Ground maize, cold pressed cottonseed cake and prairie hay.
Lot 2. — Ground maize, corn silage, and cold pressed cottonseed cake.
Lot 3. — Ground maize, corn silage and prairie hay.
Lot 4. — Ground maize a heavy feed of maize silage, and alfalfa hay.
Lot 5. — Ground maize, a medium feed of maize silage, and alfalfa hay.
Lot 6. — Maize and alfalfa hay.
In addition to the feed mentioned each steer received 1 lb of oat straw per day.

*2nd experiment.*

Lot 1. — Ground maize and alfalfa hay.
Lot 2. — Ground maize, alfalfa hay, and wheat straw.
Lot 3. — Ground maize, alfalfa hay, and a light feed of silage.
Lot 4. — Ground maize, a medium feed of silage and alfalfa hay.
Lot 5. — Ground maize, a heavy feed of silage, and alfalfa hay.
Lot 6. — Ground maize, alfalfa hay, and a heavy feed of silage at the beginning, which gradually decreased to a light feed at the close of the feeding period.
Lot 7. — Ground maize, alfalfa hay, a medium feed of silage, and cold pressed cottonseed cake.
Lot 8. — Ground maize, a heavy feed of silage, cold pressed cottonseed cake, and alfalfa hay during the first five weeks.

All of steers, excepting those in lot 2, received 1 lb of wheat straw per day.

| *Prices of feeds: 1st experiment:* | $ |
|---|---|
| Ground maize, per bushel | 0.42 |
| Cold pressed cottonseed cake, per ton. | 24.00 |
| Alfalfa hay per ton. | 8.00 |
| Prairie hay per ton. | 7.00 |
| Maize silage per ton. | 3.00 |
| Oat straw per ton. | 3.00 |
| *2nd experiment:* | |
| Ground maize, per bushel. | 0.66 |
| Alfalfa hay, per ton. | 10.00 |
| Maize silage, per ton. | 3.50 |
| Cold pressed cottonseed cake, per ton. | 26.00 |
| Wheat straw, per ton. | 2.00 |

The following tables give the results of the experiments. In the second experiment all of the steers except those in lot 3 were fed at a loss; this can largely be traced to two causes: to the rather small margin between the buying and selling prices of the steers and to the high price paid for maize.

*Results of the First Experiment.*

| Lot | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Number of steers in lot | 8 | 8 | 8 | 8 | 7 | 7 |
| Average first weight per steer lbs. | 944.00 | 939.00 | 919.00 | 975.00 | 985.00 | 945.00 |
| Average last weight per steer » | 1 247.00 | 1 254.00 | 1 194.00 | 1 327.00 | 1 306.00 | 1 305.00 |
| Total gain per steer » | 303.00 | 315.00 | 275.00 | 352.00 | 321.00 | 360.00 |
| Average daily gain » | 1.93 | 2.01 | 1.75 | 2.24 | 2.04 | 2.29 |
| *Total feed consumed:* | | | | | | |
| Maize » | 22 643.26 | 18 351.05 | 20 276.75 | 19 091.45 | 17 408.00 | 19 477.06 |
| Prairie hay » | 5 079.50 | — | 4 101.75 | — | — | — |
| Cold pressed cottonseed cake » | 3 409.57 | 3 387.36 | — | — | — | — |
| Straw » | 1 256.00 | 1 256.00 | 1 256.00 | 1 256.00 | 1 099.00 | 1 699.00 |
| Maize silage » | — | 35 934.50 | 20 746.50 | 35 755.50 | 18 290.00 | — |
| Alfalfa » | — | — | — | 6 331.00 | 6 798.00 | 8 498.50 |
| *Feed required for 100 lbs gain:* | | | | | | |
| Maize » | 934.12 | 728.00 | 922.00 | 677.96 | 774.72 | 772.90 |
| Prairie hay » | 209.55 | — | 186.30 | — | — | — |
| Cold pressed cottonseed cake » | 140.66 | 134.40 | — | — | — | — |
| Straw » | 51.82 | 49.85 | 57.10 | 44.60 | 48.91 | 43.61 |
| Maize silage » | — | 1 426.00 | 944.00 | 1 163.21 | 813.97 | — |
| Alfalfa » | — | — | — | 224.82 | 302.56 | 337.24 |
| *Cost of 100 lbs gain* $ | 9.51 | 9.29 | 9.08 | 7.79 | 8.31 | 7.22 |
| *Average cost per steer:* | | | | | | |
| Initial cost $ | 59.00 | 58.69 | 57.44 | 60.94 | 61.56 | 59.06 |
| Cost of feed » | 28.82 | 29.26 | 24.97 | 27.42 | 26.68 | 25.99 |
| Cost of marketing » | 3.12 | 3.14 | 2.99 | 3.22 | 3.27 | 3.26 |
| Total » | 90.94 | 91.09 | 85.40 | 91.69 | 91.51 | 88.31 |
| Average price received per steer » | 100.36 | 98.40 | 94.33 | 106.18 | 104.98 | 108.90 |
| Net profits per steer » | 9.42 | 7.51 | 8.93 | 14.50 | 13.47 | 20.59 |

*Results of the Second Experiment.*

| Lot | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Number of Steers in Lot | 6 | 6 | 8 | 8 | 8 | 8 | 8 | 8 |
| Average first weight per steer . . . lbs. | 896.00 | 941.00 | 921.00 | 910.00 | 932.00 | 940.00 | 945.00 | 927.00 |
| Average last weight per steer . . . » | 1 220.00 | 1 227.00 | 1 244.00 | 1 234.00 | 1 255.00 | 1 259.00 | 1 260.00 | 1 246.00 |
| Total gain per steer . . . » | 324.00 | 286.00 | 323.00 | 324.00 | 323.00 | 319.00 | 315.00 | 319.00 |
| Average daily gain . . . » | 2.10 | 1.86 | 2.10 | 2.10 | 2.10 | 2.07 | 2.05 | 2.07 |
| *Total feed consumed :* | | | | | | | | |
| Maize . . . » | 15 552.00 | 15 502.00 | 20 889.00 | 20 736.00 | 20 184.00 | 20 242.50 | 18 902.50 | 17 819.00 |
| Alfalfa . . . » | 5 793.00 | 5 618.00 | 5.460.00 | 4 754.00 | 3 956.00 | 4 111.00 | 4 337.00 | 982.50 |
| Straw . . . » | 929.00 | 2 016.90 | 1 238.00 | 1 239.00 | 1 238.00 | 1 238.00 | 1 240.00 | 1 072.00 |
| Silage . . . » | — | — | 12 072.50 | 22 566.00 | 27 429.00 | 20 901.00 | 21 407.00 | 20 655.00 |
| Cottonseed cake . . . » | — | — | — | — | — | — | 1 722.00 | 2 769.00 |
| *Feed required for 100 lbs. gain :* | | | | | | | | |
| Maize . . . » | 800.00 | 903.40 | 808.40 | 800.00 | 781.10 | 793.20 | 750.10 | 798.00 |
| Alfalfa . . . » | 298.00 | 327.40 | 211.30 | 183.40 | 153.10 | 161.10 | 172.10 | 44.00 |
| Straw . . . » | 47.80 | 117.50 | 47.90 | 47.80 | 47.80 | 88.50 | 49.20 | 48.00 |
| Silage . . . » | — | — | 467.20 | 870.60 | 1 061.50 | 819.00 | 849.50 | 925.00 |
| Cottonseed cake . . . » | — | — | — | — | — | — | 72.30 | 124.00 |
| Costof 100 lbs. gain . . . $ | 10.82 | 12.23 | 11.31 | 11.77 | 11.74 | 11.49 | 12.04 | 12.76 |
| *Average cost per steer :* | | | | | | | | |
| Initial cost . . . » | 65.41 | 68.69 | 67.23 | 66.43 | 68.04 | 68.62 | 68.98 | 67.67 |
| Cost of feed . . . » | 35.05 | 34.98 | 36.34 | 38.14 | 37.90 | 36.65 | 37.92 | 40.69 |
| Cost of marketing . . . » | 3.05 | 3.07 | 3.11 | 3.08 | 3.14 | 3.15 | 3.15 | 3.11 |
| Total . . . » | 103.51 | 106.74 | 106.68 | 107.65 | 109.08 | 108.42 | 110.05 | 111.47 |
| Average price received per steer . . . » | 103.36 | 102.52 | 107.10 | 103.54 | 106.73 | 105.00 | 104.16 | 105.17 |
| *Profit (+) or loss (—) per steer* . . . » | — 0.15 | — 4.22 | + 0.42 | — 4.11 | — 2.35 | — 5.42 | — 5 89 | — 6.30 |

*Conclusions.* — A ration of maize and alfalfa hay produced the cheapest gains of any ration used. Furthermore, the steers fed maize and alfalfa hay made as rapid gains as did the steers on any other ration.

Cold pressed cottonseed cake did not give as good results, as regards either rate of gain or economy of gain, as did alfalfa hay in a ration for fattening steers.

The addition of cold pressed cottonseed cake to a ration of maize, silage and alfalfa increased the cost of gain and lowered the profits on the steers.

The steers receiving silage without exception shed their coats early in the spring and at all times presented a sleek and sappy appearance.

Contrary to preceeding experiments, a heavy feed of silage with alfalfa hay and maize gave as rapid gains as did either a medium or a light feed of silage with alfalfa hay and maize. The amount of silage which can best be fed to fattening steers apparently must be regarded as unsettled.

The steers fed silage in connection with maize and alfalfa suffered a very slight shrinkage when shipped to market. Different amounts of silage seemingly had no effect upon the number of pounds shrinkage.

Where prairie hay was used in place of alfalfa, small and expensive gains resulted.

The individuality of a steer is a very important factor in the rate of gain. The average difference in gains made between the highest and lowest producing steer in each of 14 different lots was 120 lbs. In practically all cases there was a greater variation in the daily gains made by steers in the same lot than there was in the average daily gains of the different lots.

An advance of 8 cents. per bushel in the price of maize increased the cost of gains $ 1 per 100 lbs.

In the second experiment, where a ration of maize and alfalfa hay was fed, an increase of 1 cent per bushel in the price of maize had the same effect in increasing the cost of gains as did an increase of $ 1 per ton in the price of alfalfa hay.

SHEEP

538 – **Improvement of Italian Sheep** (1). — MASCHERONI E. in *L'Industria lattiera e zootecnica*. Year XIV, No. 3, pp. 35-36, Fig. 1. Reggio Emilia, February 1, 1916.

In order to improve Italian sheep, especially in Tuscany, the Abruzzi, Latium, most of the southern provinces and Sicily, several crosses with foreign breeds have been made with Spanish, Châtillon, and Rambouillet Merinos. The results may be considered good, for without affecting the milk production the weight of the sheep increased and the quality of the wool was finer, more silky, stronger and more abundant. A cross was also attempted between Australian Merinos and Italian " Vissane " and " Sopravissane " sheep ; also with Cotswold, Oxford, Southdown, New-Kent and Leicester rams mated with south Italian breeds, but the results were not encouraging perhaps because the experiments were isolated and on no general plan.

As regards the measures advisable for the improvement of sheep in

(1) See *B.* April 1912, No. 684. (*Ed.*).

Italy, some (amongst others Prof. MARCHI) would recommend the aim to be: 1) an increase in flesh by developing the early maturity qualities of the Bergamo breed and using superfluous animals from the breeding pens for the production of mutton; 2) a higher production of wool, with special care to avoid injury to the fleece of the Sicily, Sardinia, and Lecce breeds, by crossing exclusively with Merinos but using selection only. With Rambouillet Merinos, on the other hand the crossing should be continued with breeds already possessing a fair share of Merino blood. The production of Astrachan-like fleeces should be tried where brown varieties, etc., are available. Others, instead, chiefly advocate the improvement of wool production. BONA divides the sheep of Italy into three varieties: 1) wools of Apulia, Vissane, and Sopravissane, which are deficient only in length and uniformity, but are good for combing; 2) some Latium wools (e. g. Cingolane) and wools of the Marche, Umbria, the Appennines, Basilicata and Calabria, which are uneven, weak and coarse; 3) Tuscan, Bergamo, Venetian and Piedmontese wools which are not good from an industrial point of view. For the improvement of the first variety BONA recommends selection alone; except for the short-fleeced Apulia sheep where he advises crossing with Australian Merinos from Port Philip, or better still with the crossbreed Port Philip Merinos × Lincoln, obtaining wool sometimes as much as 5 $^{3}/_{4}$ inches long. To improve the wools of the second variety he advises crossing with Apulian Merino rams, or Southdown, Dishleys or crossbreeds, $^{1}/_{4}$ Dishley $^{3}/_{4}$ Merino. The wools obtained by these crosses are more even, sufficiently fine and silky, and fetch good prices. For the third variety he advises the employment of Southdowns, Dishley rams and $^{1}/_{4}$ Dishley and $^{3}/_{4}$ Merino cross breeds.

539 - **Tests on Milking Ewes in Hungary for Yield of Milk and Wool** — KOVÁCS J. in *Kiserletügyi Közlemények* (Comunication of the Hungarian Agronomical Station), Vol. XVIII, Part. 5-6, pp. 924-952 + Pl. XII. (Summary in German on pp. 953-955). Budapest, 1915.

The breeding of sheep for milk has always been extensively practised in Hungary, especially in the mountain regions. During the last twenty years the total number of sheep has diminished, but in a much lesser degree for milking ewes than for other types, so that now the former are by far the most numerous. The agricultural conditions in Hungary are favourable to this industry for in several regions the increase in farming is closely connected with the breeding of milking ewes. The methods used are, however, extremely primitive and very little is done to develop the capacity for milk production. In many of the flocks small attention is paid to selection while routine testing for yield is still less carried out. Generally speaking the subject has been neglected, and few data can be obtained as to the limits and fluctuations of the milk yield in a flock.

It is therefore very desirable to direct the attention of sheep breeders towards this line, and it is with this object that the writer has carried out experiments in 3 flocks, of which one consisted of Zigaja × East-Frisian crossbreeds (on the Végles farm in the district of Zólyou) and two of Zachel sheep (on the Felsökubin farm in the district of Arva, and on the Szentandrás

farm in the district of Liptó.) In each flock a certain number of sheep of the same age were chosen for the experiment, viz : 29 at Végles, 17 at Felsökubin and 20 at Szentandrás.

In order to determine the quantity of milk produced, test milkings were carried out every fortnight, and samples were kept showing the difference between the morning and evening milking, by which the fat content and the curd content obtained were determined. Besides the milk production, determinations of the quantity and quality of the wool were made. Data were obtained regarding the weight of the fleece, the loss per cent in the washing, and the results of the classification of the wool.

*Tests of milk yield.* — Unfortunately, the observations were discontinued before completion and thus it was not possible to determine the exact milk yield in any of the flocks. However, the observations made at Végles during 5 months, at Felsökubin and Szentandrás during 4 months, and the comparison between the quantity of milk obtained in each of the flocks during 3 months of milk production, have given some useful data regarding the variations in yield of the sheep under test. The results are shown in Tables I and II.

TABLE I. — *Yield in milk, fat and curd during periods of 4 and 5 months.*

| Locality | Milk yield per sheep lbs. | Fat yield per sheep lbs. | Yield of curd per sheep |
|---|---|---|---|
| Végles (5 months) . . . . . | 53.86 – 210.32 | 3.42 – 13.07 | 12.74 – 46.34 |
| Felsökubin (4 months) . . . . . | 65.08 – 171.74 | 4.08 – 11.44 | 14.63 – 45.41 |
| Szentandrás . . . . . | 69.89 – 207.59 | 4.08 – 11.44 | 13.73 – 35.80 |

TABLE II. — *Variations in the milk yield during 3 months.*

| Locality | Minimum yield lbs. | Maximum yield lbs. | Mean production per sheep | | |
|---|---|---|---|---|---|
| | | | Inferior lbs. | Middling lbs. | Good lbs. |
| Végles . . . . . | 21.78 | 109.47 | 34.61 | 52.55 | 94.03 |
| Felsökubin . . . . . | 43.83 | 125.44 | 57.10 | 81.53 | 119.16 |
| Szentandrás . . . . . | 51.35 | 158.78 | 60.80 | 81.66 | 142.46 |

The wide differences to be observed in the milk yield of the same flock show how great an advantage could be obtained by selection based on the results of similarly accurate tests.

*Tests of yield of wool.* — The results of these tests have amply proved their importance. Although, when breeding sheep for milk, wool may be

considered secondary, it nevertheless constitutes an equally important source of income.

On the basis of practical experience, it is generally admitted that an inverse proportion exists between the two factors " milk yield ", and " wool yield ", whilst the relation is direct between the two factors " milk yield ", and " fineness of wool ". The results of the investigations have, in various cases, confirmed this principle, but in others, the contrary is frequently observed. An abundant milk production appears to be associated with an abundant wool production. The Végles flock, for instance, had amongst the 5 best milk sheep 3 which produced also the largest quantity of wool. Szentandrás also, gave 3 sheep presenting this double attribute, while at Felsökubin no example of the kind occurred. In practice, tests for yield would certainly be more difficult for sheep than for cows ; but such difficulties are not insurmoutable. It would be therefore more advantageous to make these tests on a chosen group, and not on the whole number of mother ewes. This would soon ensure good progress, as the rams could be chosen exclusively from heavy-milking stock. If milking tests were furthermore practised on all the mother ewes at intervals, it would be possible to eliminate the inferior ones and their progeny, thus greatly improving the milk production of the flock.

540 - **Ground Wheat versus Whole Wheat for Fattening Pigs.** — I. Bliss, R. K. and Lee, C. B. — II. Snyder, W. P., *The University of Nebraska, Bulletin of the Agricultural Experiment Station of Nebraska, Vol. XXVII, Article I, Bulletin* No. 144, pp. 3-11 ; 12-13 ; 2 diagrams. Lincoln, Nebr., August 15, 1914. PIGS

I. — *Ground Wheat versus Whole Wheat for Fattening Pigs.* — Since in certain localities in the State of Nebraska it often happens that many farmers have an abundance of wheat and little or no maize, the Department of Animal Husbandry of the Agricultural Experiment Station at Lincoln inaugurated an experiment to determine the relative feeding values of whole wheat and ground wheat when fed to fattening pigs. It was not considered necessary to compare wheat with corn in this experiment, owing to the fact that other Experiment Stations have found ground wheat about 10 per cent more efficient than shelled maize when fed to fattening pigs. The economic advantage of ground wheat over maize as a feed for pigs is largely offset by the additional expense incurred in grinding and feeding the wheat.

Forty spring pigs divided into four lots of ten each were used in the experiment. One pig in lot 2 died at the close of the second week and was eliminated from the experiment. The following rations were fed :

Lot 1. — Soaked whole wheat.
Lot 2. — Soaked whole wheat 19 parts, tankage (slaughter-house refuse) 1 part.
Lot 3. — Soaked ground wheat.
Lot 4. — Soaked ground wheat 19 parts, tankage 1 part.

In establishing prices for feeds used, whole wheat was valued at 75 cents per bushel and tankage at $2.50 per cwt. A charge of 4 cents per bushel was made for grinding the wheat:

The experiment was begun October 27, 1913 and closed twelve weeks

later, January 19, 1914. The following table gives the main facts in connection with the experiment :

TABLE I. — *Comparative value of rations for pigs.*

| Lot | | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Number of pigs in lot | | 10 | 9 | 10 | 10 |
| Weight of lot at beginning | lbs | 1 360 | 1 245 | 1 370 | 1 395 |
| Weight of lot at close | » | 2 065 | 2 070 | 2 370 | 2 503 |
| Total gain by lots | » | 705 | 825 | 1 000 | 1 108 |
| Average first weight per pig | « | 136 | 138 | 137 | 139 |
| Average last weight per pig | » | 206 | 230 | 237 | 250 |
| Total gain per pig | » | 70.5 | 91.6 | 100 | 110.8 |
| Average daily gain per pig | » | 0.84 | 1.09 | 1.19 | 1.32 |
| Total feed consumed : | | | | | |
| Wheat | » | 4 166.4 | 5 007.5 | 4 429.6 | 4 669.7 |
| Tankage | » | — | 197.5 | — | 228.9 |
| Feed required for 100 lbs gain ; | | | | | |
| Wheat | » | 591 | 485.8 | 443 | 421.5 |
| Tankage | » | — | 23.9 | — | 20.7 |
| Cost of 100 lbs gain | $ | 7.39 | 6.67 | 5.83 | 6.07 |

When wheat comprises the entire feed for fattening pigs :

1) Three pounds of soaked ground wheat produced as much gain as 4 lbs of soaked whole wheat.

2) Ground wheat at $1 per bush. proved as economical as whole wheat at 75 cents per bush. At a cost of 4 cents per bush. per grinding, the net profit due to grinding amounts to 21 cents per bush.

3) Ground wheat produced gains 42 per cent faster that whole wheat.

4) A noticeable amount of wheat passed through the pigs undigested.

When a mixture of 19 parts wheat and 1 part tankage comprised the entire feed for fattening pigs :

1) Six pounds of ground wheat produced practically as much gain as 7 lbs of whole wheat.

2) Ground wheat at 86 cents per bushel proved as economical as 75 cents per bush. when both were fed with tankage. At a cost of 4 cents per bushel for grinding, the net saving due to grinding amounted to 7 cents per bushel.

3) Ground wheat produced gains 21 per cent faster than whole wheat when both were fed with tankage.

4) The whole wheat was apparently better digested when fed with tankage than when fed without tankage.

Ground wheat proved more profitable than whole wheat for fattening pigs, either when fed with or without tankage.

These facts lead to the following conclusions : A great saving can be effected by grinding the wheat for fattening pigs. Pigs can be fattened and marketed on a shorter feed with ground wheat than with whole wheat. Owing to the faster gains made and the better finish obtained, small amounts of tankage can be profitably fed with ground wheat. In case grinding the wheat is not practicable, a small amount of tankage fed with whole wheat will materially increase the rate of gain and, on the basis of prices given in this bulletin, will materially increase the profit obtained.

II. — *Unpublished Data from the North Platte Station.* — The following data furnish additional proof as to the economic advantage of ground wheat over whole wheat as a feed for fattening pigs.

TABLE II. — *Wheat and maize for fattening pigs. Wheat compared with corn ; whole wheat compared with ground wheat ; soaked wheat compared with unsoaked wheat.*

Average of two tests : October 21, 1913 to January 27, 1914, 98 days.
There were 9 pigs in each lot, 90 pigs in all.

| Ration | Shelled maize dry | Whole wheat dry | Whole wheat soaked | Ground wheat moistened | Ground wheat soakened |
|---|---|---|---|---|---|
| Average first weight per pig . . . . lbs | 108.8 | 109.0 | 107.5 | 108.8 | 109.3 |
| Average last weight per pig . . . . . » | 217.6 | 209.1 | 210.4 | 242.7 | 247.2 |
| Average gain per pig . . . . . » | 190.1 | 100.1 | 102.9 | 133.9 | 137.9 |
| Average daily gain per pig . . . . . » | 1.11 | 1.02 | 1.05 | 1.36 | 1.41 |
| Lbs grain for 100 lbs gain . . . . . | 468 | 510 | 504 | 426 | 413 |
| Lbs alfalfa for 100 lbs gain , . . . . . | 11 | 9 | 10 | 7 | 5 |
| Total lbs feed for 100 lbs gain . . . . . | 479 | 519 | 514 | 433 | 418 |
| * Cost of feed for 100 lbs gain . . . . $ | 5.48 | 6.42 | 6.35 | 5.64 | 5.46 |

* On the basis of the following prices : Shelled maize 65 cents per bushel. whole wheat 75 cents per bushel, ground wheat 79 cents per bushel, and alfalfa $ 10 per ton.

541 – **On the Use of Fern-root *(Pteris aquilina)* in German Pig-feeding Experiments.** — HANSEN and MEZ (University of Koenigsberg) in *Deutsche landwirtschaftliche Presse*, Year 43, No. 22, p. 193. Berlin, March 15, 1916.

The writer has made a special study of this fern (*Pteris aquilina*), which is very abundant in Gernany, and believes that the root might serve as food for pigs. It is rich in food material, is easily collected, and has even been used as human food in times of famine. The analysis made by the Agricultural Institute of the Koenigsberg University shows the chemical composition of this root to be :

| | | | |
|---|---|---|---|
| Dry matter . . . . . | 42.1 % | Crude Cellulose . . . . . | 7.0 % |
| Crude protein . . . . . | 4.0 » | Nitrogen-free extract . . . . | 28.7 » |
| Pure protein . . . . . | 3.6 » | Ash . . . . . | 1.7 » |
| Fats . . . . . | 0.7 » | | |

The amount of food material is therefore relatively high. Unfortunately the large proportion of crude cellulose slightly diminishes the digestibility of the other constituents. The writer has also carried out some feeding experiments on cows and pigs with this root. The cows refused it, probably because of its bitter taste. The pigs, on the contrary ate it, at first in small quantities. The writer chose for his experiments some young pigs weighing about 44.09 lbs. At first they were given 0.22 then 1.10 and finally 1.54 lbs. of root per head daily. Though this experiment had to be stopped after a certain time, it has, however, proved that fern root is a good food. No intestinal derangements occurred. The writer is at present making further experiments with pigs of the average weight of 55 and 66 lbs. The quantity of fern-root given daily was at first 0.66 lbs. per head. but at the present time the quantity has been increased to 2.25 lbs. per day per head. Although the experiment is not yet finished it confirms the previous trial in showing the fern root to be a good food for pigs. The writer is continuing these experiments and advises others to repeat them.

POULTRY

542 - **Report of the Third Egg-Laying Competition Held in Ireland from October 1st 1914 to August 31st 1915.** — MURPHY L. in *Department of Agriculture and Technical Instruction for Ireland*, Vol. XV, No. 1, pp. 80-98. Dublin, October 1915.

The Third Irish Egg-Laying Competition conducted by the Department of Agriculture and Technical Instruction for Ireland was held at the Munster Institute, Cork.

In addition to 15 non-competing pens, there were 33 pens (each of 6 fowls) of the following breeds and varieties: White Wyandotte, — Rhode Island Reds — Buff Orpingtons — White Leghorns — Brown Leghorns — Black Minorcas — Red Sussex. The 4 first places in the 11 months' laying record belong to the White Wyandotte pen. The best Wyandotte laid 271 eggs in 47 weeks and was still laying well at the close of the competition.

The observations made during the competition confirm the belief that small eggs, especially in the case of the White Wyandottes, are in a great measure due to the use of male birds, the progeny of heavy layers of small eggs ; these observations also showed that undue tendency to broodiness is transmitted by the male parent.

FISH.

543 - **Recent Research on the Ascent of Rivers by Salmon.** — ROULE LOUIS, in *Comptes Rendus de l'Académie des Sciences*, Vol. 151, No. 23, pp. 707-709. Paris, December 6, 1915.

The factors determining the ascent of rivers by salmon are governed by the proportion of oxygen dissolved in the water. This is proved by the ascent of salmon taking place only in those rivers where the proportion is near the limit of saturation, or surpasses it by the occurrence of supersaturation, already noted by several observers. This view is based on previous researches made by the writer in the spring, and is confirmed by others carried out in the autumn and described in the present notice.

The direction of the migration proceeds from areas of low oxygen content to those of higher content, the maximum being always present where the salmon will spawn.

The salmon ascending from the mouth of the estuary and after entering the river makes its way continuously towards the place suitable for spawning (with the current on a rising tide and against the current on the ebb) towards an area rich in oxygen and favourable to increased respiration. The practical conclusion to be drawn is that, when stocking rivers and streams with salmon, only those should be chosen that are sufficiently rich in oxygen, otherwise the operation would probably fail.

544 – **Researches on the Toxic Effect of Sulphuric Acid on Pond-fish.** — HAEMPEL O. in *Zeitschrift für Fischerei*, New Series, Vol. I, No. 3-4, pp. 155-167. Berlin, 1915.

Water coming from industrial establishments often contains sulphuric acid, and if allowed to flow into ponds used for pisciculture, may be injurious to the fish. The writer's object is to ascertain to what extent the theory is correct. Several fish (carp, trout, and salmon) were placed in an aquarium containing chemically neutral water (cold or tepid) to which sulphuric acid was afterwards added in different amounts. The same experiment was made, for purposes of comparison, with invertebrates (*Gammarus pulex, Chloën dipterum, Tubifex tubifex*, etc.).

The experiment proved that the free sulphuric acid has a toxic effect both on the fish and on the invertebrates. In the water to which 20 or 30 mgms. of $SO_3$ were added per litre the toxic effect upon the fish was marked; with a dose of 140 or 150 mgms. the toxic effect was very marked. Considering that the pond water is more or less rich in lime which partly neutralizes the acid, it may be admitted that in practice 50 mgms. of the acid per litre will be necessary to produce a noticeably toxic effect, and 200 mgms. to produce an markedly toxic effect. The degree of poisoning depends also on the temperature of the water, as at lower temperatures the fish are more resistant, being more able to neutralize the acid in the water. If the water is too acid, the fish secrete an excess of mucus in order to protect the branchiae and epidermis from being injured by the acid.

The writer has also examined the dead fish poisoned by the sulphuric acid. In one case where the water contained 140 mgms. of pure acid per litre, he found a slight acid reaction in the fresh mucus. On the other hand in some cases where the dead fish had remained in that condition for 24 hours it was impossible to find any trace of the acid either in the branchiæ or the intestines. The writer therefore believes it to be exceedingly difficult to determine whether the fish has been poisoned by the acid or not; this can only be done when the fish has died from acute poisoning and has been examined immediately after death. In practice such cases are rare.

The behaviour of the invertebrates is slightly different. The common freshwater shrimp is the most susceptible to the acid and dies in 5 hours if the water contains 20 mgms. of concentrated sulphuric acid per litre. With the same dose, the larvae of *Chloën dipterum* die only after ecdysis; normally they can withstand as much as 40 mgms. of the pure acid. The most resistant of the invertebrates are *Asellus aquaticus* and *Tubifex tu-*

*bifex*; the toxic doses of concentrated sulphuric acid per litre are 80 mgms. for the former and 100 mgms. for the latter.

545 - **Damage caused to Fish-culture in Hungary by the Residual Waters from Starch Manufactories.** — See No. 557 of this *Bulletin*.

546 - **Fish-culture and the Biological Purification of Sewer Water at Charkow (South Russia).** — GADD G. in *Khosiaistvo* (The Farm), Year XI, No. 1-2; pp. 23-24. Kiev, January 15, 1916.

Until quite recently fish-culture had not been applied to the biological purification of sewer water in any Russian town. Recently, however, the Municipality of the town of Charkow constructed the first biological Station for purifying sewer water by means of basins and filters. From the filters the water passes into ponds containing fish, through the agency of which it is definitely purified. There are 3 ponds which cover a total area of 4 acres. In the spring of 1915, 215 yearling carps were placed in the ponds. Towards the end of July the carps weighed 1 ¼ lbs. This small increase in weight can be explained by the sandy nature of the soil. The first attempt to breed carp was made in 1914, and failed, all the fish having died in the winter. The mortality was caused by the low oxygen content of the water, which was covered by a layer of ice. In these ponds, the only possible method is therefore to stock the ponds with fish in spring and catch the fish in winter. The number of ponds at the Charkow Biological Station will increase in proportion to the increase of the sewage area.

## FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

547 - **Duty-free Admission of Agricultural Implements and Machinery into Greece.** — *The Implement and Machinery Review.* — Vol. 41, No. 492, pp. 1410-1411. London, April 1, 1916.

A Royal Decree has been published in Greece, which exempts the following articles for a period of four years from January 1/14, 1916, from State import duty and from harbour, communal, municipal, or other tax, on importation into Greece from abroad, or on being transported from one district to another in Greece, *viz*:

Ploughs and hoes.

Harrows, clod breakers and horse hoes (cultivators).

Machines for sowing, for planting potatoes and for distributing manures.

Harvest machines *i. e.* reaping machines, mowers, hay turners, hay-gathering machines, machines for digging up potatoes, and threshing machines, as well as implements for reaping and threshing.

Machines for cleaning and sifting seeds, ginning (shelling) machines, machines for preparing fodder, hay pressing machines and straw elevators.

Implements and machines for combating vegetable and animal parasites.

Implements, machines, ustensils and tools for wine-making, for the

milk, butter and cheese industries, for the olive oil industry, for apiculture, sericulture, poultry farming, viticulture, arboriculture and for fruit and vegetable packing.

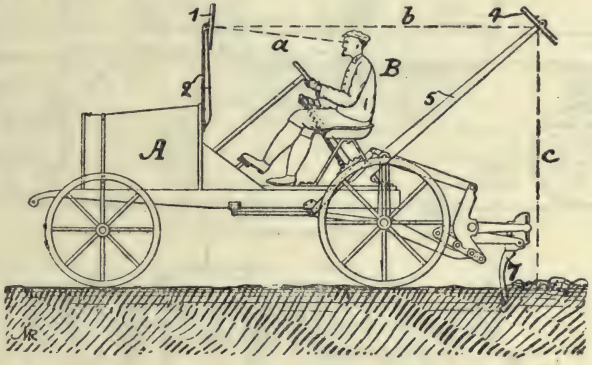
Motors for reaping or threshing machines *i. e.* motors worked by horses, by steam or electricity or driven by crude petroleum and petrol.

Means for the conveyance of motive power, *i. e.* leather belts, chains and wire for conducting electric power.

Pumps.

548 - **Mirrors for Motor Tilling Machines.** — MAX RINGELMANN in *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year 114, 2nd half year, No. 6, Vol. 124, p. 690, 1 fig. Paris, November-December 1915.

With most outfits for mechanical tilling the driver is obliged to turn round and look backwards, in order to see the work that he is doing. With




MIRROR BY MESSRS PEUGEOT BROS. AND GOBIET

the object of avoiding this, Messrs PEUGEOT Bros. and GOBIET of Valentigney (Doubs) have patented (English patent No. 12747, May 1915) the use of mirrors 1 and 4 (see accompanying figure) mounted on suitable supports 2 and 5 fixed to the motor A. The inclination of the mirrors can be so adjusted as to allow the driver B to see in mirror 1 the work which is being done by the implement 7 and alter it at will.

This device, especially suitable for small one-man outfits, can easily be applied to any machine.

549 - **A Chaff-cutter for Litter, provided with Pneumatic Delivery and Press.** — In *Illustrierte Landwirtschaftliche Zeitung*, 35th Year, No. 20, p. 142, 4 figs. Berlin, March 8, 1916.

An appreciable economy of litter can be effected by using the straw cut up into small pieces, but the extra work required for this cancels any benefit resulting from the process. The machine described obviates this extra work, being constructed for coupling up with a threshing-machine, instead of a straw press.

The machine, made by Messrs. WILHELM LANVERMEYER of Melle (Han-

nover) and patented under N° 259 469, in Germany, belongs to that type in which a rotary toothed mill (" umlaufende gezahnte Scheiben ") presses the

*Chaff-cutter for Litter, provided with Pneumatic Delivery and Press.*

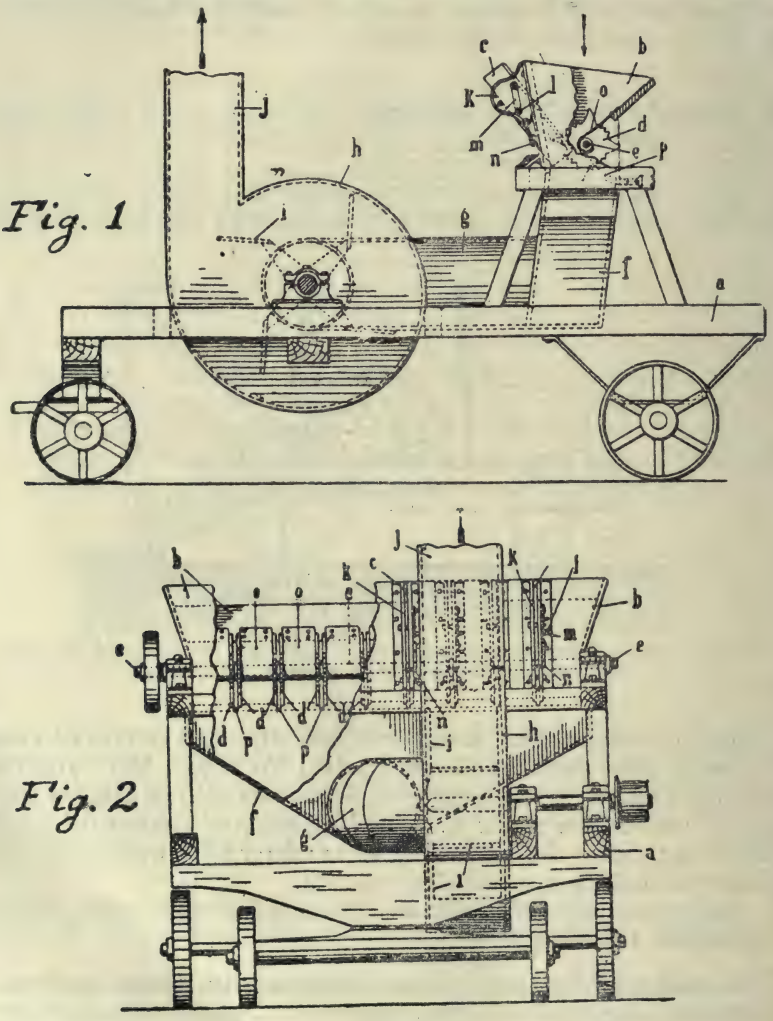



Fig. 1: Side elevation.
Fig. 2: Front elevation.

straw against fixed knives, but it has the following advantage over other patterns: the knives can be removed and changed while the machine is running and they are protected from injury by foreign bodies introduced

into the machine by means of flexible supports, which allow them to move back into the machine. The machine is also provided with an apparatus which sucks up the cut straw and then forces it towards the place where it is to be used or stored.

In fig. 1, the machine is seen in side-view and in fig. 2, from the front (breadth). Fig. 3 shows the cutter on a larger scale in longitudinal section,

*Detail of Chaff-cutter.*

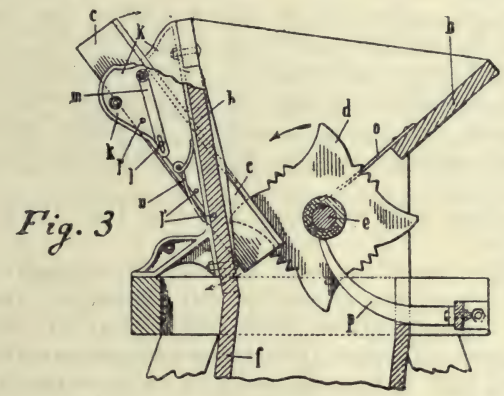



Fig. 3

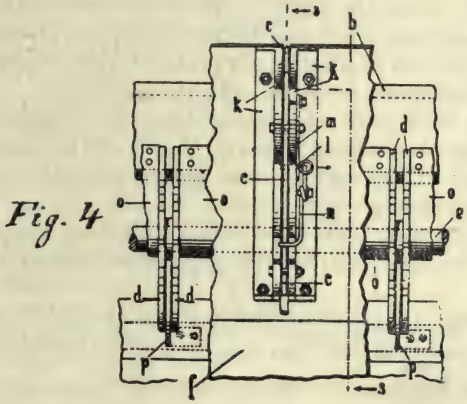



Fig. 4

Fig. 3: Longitudinal section.
Fig. 4: Corresponding front view.

while fig. 4 gives the corresponding front-view showing how the bolt on which the knife works is mounted on a flat spring.

As shown in figs. 1 and 2, the straw-cutter, mounted on a slide, is composed of the following chief parts : a feeding-hopper *b*, a set of knives , and the toothed mills *d* approximately square in shape. Under the mills, which are mounted in pairs on a moving shaft, is a gathering-hopper *f*,

communicating with the suction-pipe *g* of the apparatus *h* for suction and compression. The fan *i* of this apparatus forces the chopped straw into a pipe *j*, ending at the point where the straw will be stored. One of the sides of the hopper is adjustable and can be arranged drawer-fashion in such a way that only the least valuable and lower portion of the straw would be sucked up, leaving the upper and more nutritive portions in the suction-hopper, from which it can afterwards be removed for other purposes (*e. g.* for fodder). The straw cutter (figs. 3 and 4) carries, on a frame *k* fixed to the feeding hopper *b*, the knives *c* which turn round pins *l*, pressed by flat springs into the holes *l'* of the knives. When the upper end of the spring is screwed to the fixed part of the mechanism (fig. 4), the pin and spring can be pulled out sufficiently to allow the knife to be shifted by means of the holes *l'* either for removal, or for adjustment Finally, when the pin is released, the spring presses it in place, provided that the knife is in such a position that the holes *l'* correspond with those of the chassis *k*.

The knives *c* are held by springs *n* so that their lower end is clear of the pairs of mills.

For the mills to work properly, the long straw should be fed parallel to the motive shaft and not allowed to roll around it. This is controlled by the guards *o* placed between each pair of toothed mills, fastened to the feeding hopper, and with their lower ends surrounding the shaft *e*. In addition, each pair of mills is separated by a scraper *p* which prevents the straw wrapping round the shaft. When the shaft *e* turns and with it the toothed mills, and long straw is fed into the hopper, the straw is taken by the teeth on the mills and carried down on to the knives, which cut it, and the straw then drops down into the collecting hopper *f*.

If hard bodies, such as wood or stones, are fed amongst the straw into the cutter, they cannnot press against and thus stop the shaft of the toothed mill, because owing to the springs, the knives can move back and allow them to fall underneath the cutter.

The chopped straw accumulates in the collecting hopper is and lifted thence by the suction produced by the apparatus *h* which forces it into the delivery pipe *j*.

The " Deutsche Landwirtschaftliche Gesellschaft " (German Agricultural Society) has described the machine as " new and remarkable ".

550 – **Tree-Felling by Machinery.** — *Engineering*, Vol. CI, No. 2618, p. 213. London, March 3, 1916.

A demonstration of tree felling by machinery took place in February last near Stirling, Scotland. The machine used was a No. 2 tree-feller guaranteed to fell any tree up to 48 inches in diameter. It was designed by Messrs A. RANSOME AND CO. The machine was supplied with steam from a 7 nominal-horse-power traction engine through a 120 ft. length of patent metallic steam hose covered with felt and canvas. This length allows all the trees within an area of about 1 acre to be felled without shifting the boiler. Though the ground was covered with snow, sufficient steam was kept up to run the machine at full speed.

Three trees, tough oaks of an average diameter of 46 inches, were felled in about 13 minutes each. Under normal conditions, trees varying from 42 to 48 inches have been cut in from 6 to 8 minutes, and spruce in about half the time. In the course of the demonstration it took 4 or 5 minutes to shift the machine, which is fitted with removable wheels, from one tree to another.

Usually a small portable 4 nominal-horse-power boiler which can be easily moved by one horse, is supplied with the tree feller. The advantage of the traction engine is that it can drag the trees where required after being felled.

The machine accomplished in a few minutes the work which would have taken two men four or five hours.

The trees were all felled at the ground level, and the clean cut made by the saw adds to the selling value of the timber, apart from the saving of wood. Only two men are required to work and shift the whole outfit. With the machine an interchangeable frame is usually supplied by means of which the trees can easily be cut to any required length after they have been felled.

551 – **Review of Patents.**

*Tillage machines and implements*

| | | |
|---|---|---|
| Canada | 166 550. | Disk harrow. |
| | 166 567. | Harrow. |
| | 166 576 — 166 762. | Cultivators. |
| Italy | 151 102. | Turn-wrest plough. |
| | 151 289. | Plough. |
| Spain | 61 299. | Plough. |
| Switzerland | 71 995. | Shovel harrow. |
| United-Kingdom | 23 116. | Plough. |
| United-States | 1 168 594. | Disk plough. |
| | 1 168 943. | Cultivator. |
| | 1 169 036. | Plough attachment. |
| | 1 169 127. | Disk cultivator. |
| | 1 169 156. | Stalk cutter. |
| | 1 169 183. | Furrowing attachment. |
| | 1 169 285. | Attachment for ploughs. |
| | 1 169 839. | Means for shifting gang frames of cultivators. |
| | 1 169 840. | Adjustable gang frame for cultivators. |
| | 1 170 114. | Sharpening device for disks of disk harrows. |
| | 1 170 584. | Two-row cultivator. |
| | 1 170 585. | Plough. |
| | 1 170 635. | Motor plough. |
| | 1 170 740. | Disk furrow opener. |
| | 1 170 761. | Spring toothed harrow. |
| | 1 170 879. | Combined cultivator and weeder. |

*Manure distributors.*

| | | |
|---|---|---|
| Canada | 166 682. | Fertilizer distributor. |
| | 166 884. | Manure loader. |

*Drills and sowing machines.*

| | |
|---|---|
| Canada | 166 275. Corn planter. |
| United-Kingdom | 21 965. Machine for sowing and cultivating cereals. |
| United-States | 1 168 859. Seed planter. |
| | 1 169 055. Planter. |
| | 1 169 275. Row marker for corn planters. |
| | 1 169 945. Grain drill. |
| | 1 170 237. Universal planter. |
| | 1 170 696. Disk drill. |
| | 1 170 785. Corn planter mechanism. |
| | 1 171 178. Corn planter harrow attachment. |
| | 1 171 206. Check row attachment for planters. |
| | 1 171 239. Planter attachment for cultivators. |
| | 1 171 265. Attachment for corn planters. |

*Reapers, mowers and other harvesting machines.*

| | |
|---|---|
| Canada | 166 086. — 166 309. Shocking machines. |
| | 166 300 — 166 660. Sheaf carriers. |
| France | 475 095. Motor harvester. |
| Switzerland | 71 996. Cutting apparatus for mowers. |
| | 71 997. Hay harvesting machine. |
| | 71 998. Grass spreader. |
| United-States | 1 168 365. Machine for shocking grain. |
| | 1 168 384. Mower attachment. |
| | 1 169 031. Buts board for grain binders. |
| | 1 169 048. Self binding harvester. |
| | 1 169 647. Hay spreader. |
| | 1 170 605. Folding hay rake. |
| | 1 170 692. Harvester. |
| | 1 170 701. Rake. |
| | 1 170 736. Hay sweep. |
| | 1 170 799. Binder. |
| | 1 170 882. Grain shocker for harvesting machines. |

*Machines for lifting root crops.*

| | |
|---|---|
| Denmark | 20 955. Machine for lifting and topping roots. |
| United-States | 1 168 804 — 1 169 229 — 1 169 673 — 1 170 944. Beet harvesters. |
| | 1 169 172 — 1 169 367. Potato diggers. |

*Threshing and winnowing machines.*

| | |
|---|---|
| Canada | 166 182 — 166 742. Threshing machines. |
| | 166 463 — 166 848. Grain separators. |
| Spain | 61 386. Improvements in winnowers. |
| United-States | 1 168 282. Grain separator. |
| | 1 168 550. Grain and seed separator and cleaner. |
| | 1 169 040. Convertible cow-pea and small grain thresher. |

*Machines and implements for the preparation and storage of grain, fodder, etc.*

| | |
|---|---|
| Canada | 166 012. Feed mechanism for grain grinders. |
| Italy | 150 948. Esiccator for cereals: rice, wheat, maize, etc. |
| Spain | 61 056. Machine for cleaning, selectioning and sorting potatoes. |

| | | |
|---|---|---|
| Switzerland | 72 275. | Groats cleaning machine. |
| United-Kingdom | 21 359. | Baling press. |
| | 23 469. | Mixer for chaff, bran, meal, chop etc. |
| United-States | 1 168 898. | Portable grain elevator. |
| | 1 169 200. | Corn shredding and husking machine. |
| | 1 169 288. | Rotary potato sorter. |
| | 1 170 470. | Hay baler. |

*Dairying machines and implements.*

| | | |
|---|---|---|
| Canada | 166 057. | Milking machinery. |
| | 166 203. | Milking machine. |
| United-Kingdom | 21 867 — 21 873. | Cow milkers. |
| United-States | 1 170 328. | Cream separator. |

*Other agricultural machines and implements.*

| | | |
|---|---|---|
| Canada | 165 790. | Shearing apparatus. |
| | 166 032. | Fruit sorter. |
| | 166 036. | Fowl plucking device. |
| | 166 217. | Egg candler. |
| | 166 764. | Wind motor. |
| | 166 777. | Conveyor mechanism for removing manure from stables. |
| France | 479 402. | Circular saw, for felling trees, the teeth of which are alternate blades and planes. |
| Italy | 149 985. | Machine for separating and cleaning grape seeds. |
| | 151 216. | Field tractor especially adapted for ploughing. |
| Spain | 61 409. | New apparatus for raising water from wells. |
| United-Kingdom | 21 255. | Packing for bananas. |
| | 21 360 — 21 780. | Oil presses. |
| | 21 815. | Apparatus for depericarping palm nuts etc. |
| | 21 884. | Chain pumps. |
| | 22 390. | Sugar cane mills. |
| | 22 392. | Feeding appliances for fowls. |
| | 22 489. | Oscillating churn for receptacle for coagulating rubber. |
| | 23 411. | Apparatus for seasoning timber. |
| | 23 499. | Apparatus for cleansing casks. |
| United-States. | 1 168 934 — 1 169 153 — 1 161 165. | Tractors. |
| | 1 168 975. | Wind mill. |
| | 1 169 732. | Farm tractor. |
| | 1 170 238. | Gradual shifting draught hitch. |
| | 1 170 583. | Draught equalizer. |
| | 1 170 673. | Straw spreader. |

## RURAL ECONOMICS.

552 - **A Study of the Tenant Systems of Farming in the Yazoo-Mississippi Delta, United States.** — BOERGER E. A. and GOLDENWEISER E. A. in *United States Department of Agriculture Bulletin*, No. 337, 18 pp. Washington D. C., January 13, 1916. RURAL ECONOMICS

This study is based on 878 records which were secured from planters or managers of plantations, in 9 Counties in the State of Mississippi. The records referred to the crop year 1913, and were secured during March and

April 1914. In this region 76 per cent of the land is devoted to cotton, 21.2 per cent to maize, and only 2.8 per cent to other crops. Ninety-two per cent of the farms in the Delta are worked by tenants, 95.4 per cent of which are negroes. Three general systems of renting land are practised in the Yazoo-Mississippi Delta: share croppers, who supply nothing but their labour and receive one-half of the crop; share renters, who supply their own implements and live stock and receive two-thirds or three-fourths of the crop; and cash renters who supply the same items as share renters but pay a fixed rent in cash or lint cotton. The purpose of this research is to determine the effect of each of these three systems on the conditions and profitableness of the plantations, both for the tenants and for the landlords. The following table shows the relationship between the principal factors of production and the method of renting land.

TABLE I. — *Factors of Production in Relation to Method of Renting.*

| | All records | Share croppers | Share renters | Cash renters |
|---|---|---|---|---|
| Number of records | 878 | 445 | 136 | 297 |
| Acreage in crops per tenant | 23.4 | 19.3 | 27.1 | 28.0 |
| Per cent in cotton | 83.0 | 88.0 | 77.0 | 81.0 |
| Yield of cotton per acre (bales) | 0.66 | 0.69 | 0.69 | 0.61 |
| Yield of corn per acre (bushels) | 24.0 | 24.0 | 23.0 | 24.0 |
| Total value of farm property per tenant | $ 2 176.00 | $ 1 811.00 | $ 2 504.00 | $ 2 574.00 |
| Total value of farm property per acre | $ 92.92 | $ 93.95 | $ 94.40 | $ 92.09 |
| Value of implements and machinery per acre | $ 1.73 | $ 1.52 | $ 2.00 | $ 1.83 |
| Labor income per tenant | $ 392.00 | $ 333.00 | $ 398.00 | $ 478.00 |
| Average earned by outside labour | $ 23.00 | $ 27.00 | $ 25.00 | $ 15.00 |
| Proportion of total income received by labour (per cent) | 73.0 | 67.0 | 70.0 | 82.0 |
| Average rate of interest on landlord's investment (per cent) | 10.6 | 13.6 | 11.8 | 6.6 |

It will be seen that share croppers have a smaller acreage than share renters and cash renters, and that their land is more exclusively devoted to cotton than that of the others. Cash renters produce smaller crops than the share croppers or share renters in whose crops the landlord is directly concerned. The average investment is considerably less in holdings of share croppers than in those of share renters or of cash renters, but this difference is due very largely to the fact that the share croppers' holdings are smaller and less machinery is used on them. The total labour income of cash renters and share renters is superior to that of share croppers,

which is partly accounted for by the difference in size of the holdings ; the largest income being $ 18 per acre for cash renters, $ 17 for share croppers and $ 15 for share renters.

Out of every dollar earned by the farms, the cash renters in the Delta retained 82 cents, the share renters 70 cents, and the share croppers 67 cents. The average rate of interest on the landlord's investment was 13.6 per cent on land rented to share croppers, 11.8 per cent on land in the hands of share renters, and 6.6 per cent on land operated by cash renters.

Forming different groups for the three systems, according to their labour income, an idea of the influence of the system on the amount of the labour income may be formed by comparing the number of tenants belonging to each group . At the same time the influence of these systems on the landlords' profits can be judged by adding to this the rate of interest received by the landlords in the same groups, as is shown in the following table.

Only one of the share croppers had a deficit during the year, and only 2.7 per cent of them made less than $ 100 ; the great majority of the share croppers (86.3 per cent) had labour incomes of between $ 100 and $ 499, and only one-tenth of them made as much as $ 500. Of the share renters 2.9 per cent reported deficits and 5.1 per cent positive incomes of less than $ 100 ; about two-thirds made between $ 100 and $ 499, and more than one-fourth made $ 500 and over. In the case of cash renters 4.4 per cent lost money and 5.4 per cent made less than $ 100 ; but only a little more than one-half (53 per cent) had labour incomes of between $ 100 and $ 499, and 37 per cent made $ 500 or more, as many as 25 or 8.4 per cent being in the $ 1,000 and over class. This shows that the share cropping system runs the smallest risk of losses and gives the surest profit to the tenant.

The share cropper is practically sure of receiving an average labour income, but will on the other hand rarely make a higher one. In the case of these renters, there are more failures, more very small incomes but also more probabilities of making a higher one ; while for cash renters though the risk of loss is very high, there is also still greater probability of making an income above $ 500.

For the landlord it is the reverse. The landlord made 1.1 per cent on his investment in the case of the share cropper who lost money, and only 3.1 per cent where the tenant made under $ 100, but the rate increases rapidly with the tenants' labour income, and in the cases where the tenant made as much as $ 1,000 he gave the landlord a return of over 25 per cent. In case of the share renters the landlord in no group averaged less than 7.1 per cent and his rate of interest rose as high as 16.6 per cent where the tenant had a labour income as high as $ 1,000. In the case of cash renters the landlord's rate of interest varied within much narrower limits, the lowest being 5.7 per cent, where the tenants made less than $ 100, and the highest 8 per cent where the tenants reported a deficit. The landlord is therefore assured of a return of 6 or 7 per cent on his investment independently of the tenants' labour income, where the land is operated by cash renters ; where the land is worked by share renters or share croppers, the

TABLE II. — *Labour Income in Relation to Method of Renting.*

| Class of tenants | Total | Labour income | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Deficit | Under $ 100 | $ 100 to $ 199 | $ 200 to $ 299 | $ 300 to $ 399 | $ 400 to $ 499 | $ 500 to $ 599 | $ 600 to $ 699 | $ 700 to $ 799 | $ 800 to $ 899 | $ 900 to $ 999 | $ 1000 and over |
| | Number having each income | | | | | | | | | | | | |
| All tenants. . | 878 | 18 | 35 | 105 | 194 | 209 | 123 | 62 | 39 | 34 | 19 | 9 | 31 |
| Share croppers | 445 | 1 | 12 | 57 | 123 | 143 | 61 | 26 | 12 | 6 | 2 | — | 2 |
| Share renters . | 136 | 4 | 7 | 20 | 21 | 25 | 23 | 10 | 8 | 8 | 5 | 1 | 4 |
| Cash renters. . | 297 | 13 | 16 | 28 | 50 | 41 | 39 | 26 | 19 | 20 | 12 | 8 | 25 |
| | Per cent having each income | | | | | | | | | | | | |
| All tenants . . | 100.0 | 2.0 | 4.0 | 12.0 | 22.1 | 23.8 | 14.0 | 7.1 | 4.4 | 3.9 | 2.2 | 1.0 | 3.5 |
| Share croppers | 100.0 | 2 | 2.7 | 12.8 | 27.6 | 32.1 | 13.7 | 5.8 | 2.7 | 1.4 | .5 | — | 5 |
| Share renters . | 100.0 | 2.9 | 5.1 | 14.7 | 15.4 | 18.4 | 16.9 | 7.4 | 5.9 | 5.9 | 3.7 | .7 | 3.0 |
| Cash renters . | 100.0 | 4.4 | 5.4 | 9.4 | 16.9 | 13.8 | 13.1 | 8.8 | 6.4 | 6.7 | 4.0 | 2.7 | 8.4 |
| | Average income for each income group | | | | | | | | | | | | |
| All tenants . . | $ 392 | $ 64 | $ 63 | $ 156 | $ 249 | $ 345 | $ 447 | $ 542 | $ 649 | $ 746 | $ 857 | $ 950 | $ 1,344 |
| Share croppers | 333 | 126 | 68 | 162 | 250 | 342 | 447 | 536 | 648 | 752 | 887 | — | 1,445 |
| Share renters . | 398 | 77 | 62 | 154 | 256 | 348 | 447 | 542 | 646 | 750 | 847 | 910 | 1,220 |
| Cash renters . | 478 | 56 | 59 | 146 | 245 | 354 | 448 | 547 | 656 | 743 | 856 | 956 | 1,355 |

landlord's rate of interest often falls below 6 per cent, but when the yield is good and the tenant makes a good return, the rate of interest may rise to three times that amount.

In other tables and diagrams the writer also shows the relationship between acreage in cotton and yield per acre, tenant's labour income and landlord's profits according to each system. The holdings of share croppers are considerably smaller, on the average, than those of share renters or of cash renters and there are few share croppers having as much as 25 acres in cotton, while about one-third of the share renters and of the cash renters have at least that acreage. The labour income of tenants increases directly with the increase in cotton acreage, but the rate of interest on the landlord's investment appears to be little affected by the size of the holdings. The principal factor in determining the amount of the tenant's labour income and the rate of the landlord's profits in this region is the yield of cotton per acre. The relationship between yield of cotton and labour in come, however, is much closer on cash renters' farms than on those of share croppers, while the effect of yield on the landlord's profits is more apparent under the share cropping than under the share renting or the cash renting system. The tenant's incentive for securing a good crop is consequently geaater among those who rent for cash, but on the other hand, the landlord is more directly interested in the magnitude of the yield per acre on the land of his share croppers.

553 – **Some Factors for Success in Farming in Wisconsin U. S. A.** — WARTRUD H. O. in *Hoard's Dairyman*, Vol. 41, No. 3, pp. 97-98. Fort Atkinson, February 11, 1916.

Data collected from a large number of farms in Wisconsin have enabled the writer to study the relationship between the farmer's managerial income and the following factors : *a*) size of farm ; *b*) working capital in proportion to fixed capital ; *c*) quality of dairy sire ; *d*) quality of cows ; *e*) number of cows ; *f*) quantity of foods bought in proportion to foods sold.

The results of these investigations are given in the following charts :

*a*) Size of farm.

| No. of farm | Size in acres | Average acreage | Total receipts | Managerial income |
|---|---|---|---|---|
| 10 | Under 100 | 79 | $ 3,063 | $ 1,519 |
| 12 | 100–150 | 124 | 4,696 | 1,727 |
| 11 | 150–190 | 166 | 5,276 | 1,848 |
| 12 | 190–240 | 221 | 4,929 | 1,809 |
| 8 | over 240 | 275 | 5,956 | 1,888 |

*b*) Working capital in proportion to fixed capital :

| No. of farm | Percentage of fixed capital | Percentage of working capital | Managerial income |
|---|---|---|---|
| 15 | 86.5 | 13.5 | $ 167.78 |
| 12 | 82.3 | 17.7 | 433.68 |
| 6 | 71.8 | 28.2 | 1,628.58 |
| 6 | 66.7 | 33.3 | 3,511.33 |

*c*) Quality of dairy sire.

| Sire | No. of farms | Acreage | Total capital | Percentage of working capital | Total receipts | Managerial income |
|---|---|---|---|---|---|---|
| Grade . . . . . | 13 | 149 | $ 20,748 | 16.6 | $ 2,614 | $ 140 |
| Pure-bred . . . | 23 | 167 | 21,990 | 17.9 | 4,429 | 782 |
| Special. . . . . | 20 | 178 | 42,897 | 39.1 | 12,206 | 2,854 |

*d*) Quality of cows.

| Class | No. of farms | Milk and stock receipts | Total receipts | Managerial income |
|---|---|---|---|---|
| All grade cows . . . . . | 19 | $ 2,770 | $ 3,572 | $ 1,300 |
| Less than 30 % pure bred. | 13 | 4,113 | 5,320 | 1,173 |
| More than 30 % pure bred | 10 | 5,739 | 6,000 | 1,816 |
| All cows pure bred . . . . | 8 | 6,395 | 6,594 | 2,106 |

*e*) Number of cows.

| No. of farm | Average number of cows | Managerial income |
|---|---|---|
| 9 | 11 | $ 643 |
| 9 | 17 | 1,422 |
| 15 | 23 | 1,815 |
| 10 | 35 | 2,354 |

*f*) Quantity of food bought in proportion to food sold.

| Class | No. of farms | Ave. size acres | Total capital | Percentage of operating capital | Total receipts | Managerial income |
|---|---|---|---|---|---|---|
| Sales > purchases . | 26 | 173 | $ 23,129 | 18.6 | $ 3,909 | $ 1,425 |
| Purchases > sales . | 28 | 160 | 30,656 | 31 | 5,644 | 1,749 |

From the foregoing charts regarding the region under consideration it is found that :

*a*) although the total receipts increase with the increase in acreage, the managerial income remains about constant ;

*b*) the managerial income is greatly increased with the increasing percentage in operating capital ;

*c*) the quality of sires has a direct influenece on the managerial income because of the high price attained by pure bred stock ;

*d*) the quality of the cows vitally influences the net profit, the best results being obtained by good dairy herds, or herds containing not less than 30 % pure bred cows ;

*e*) there is a very close association between the number of dairy cows on the farms and the managerial income, and the best results are obtained by herds of about 35 cows, which would warrant the employment of another man for the whole course of the year; in practice this extra man is often the farmer's son who is constantly employed on the farm ;

*f*) the purchase of concentrated feeds contributes to the increase of income ; all the farms which buy more crops than they sell having a considerably superior income.

554 - **Farm Valuations for Book-keeping Purposes.** — WYLLIE J. (Lecturer on Book-keeping, West of Scotland Agricultural College) in *The Journal of the Board of Agriculture*, Vol. XXII, No. 12, pp. 1215-1228. London, March 1916.

The new method adopted for assessing farm income tax in England has induced the writer to indicate in his article how the farmer should proceed to lay a sound and necessary foundation upon which he may construct whichever system of accounts he considers most suitable for his particular circumstances. The first step is to make a complete inventory and valuation of all the various classes of stock, both live and dead, upon the farm. He must also make out an accurate statement of all debts payable and debts receivable, and ascertain how much cash he has in hand and in the bank. In other words, he must draw up a Balance sheet showing his total assets and total liabilities, and thence find out how much Capital he has invested in the farm. The annual revision of the Balance sheet will show whether his capital in the farm is increasing or decreasing, but not what profit or loss has accrued from a year's working of the farm.

*Date at which the valuation should be made.* — The writer shows that the best and most desirable date will be that at which there is a minimum of valuation to effect, for as regards book keeping purposes, a valuation is, at best, to be looked upon as a necessary evil, which should be avoided as far as possible. This principle does not always coincide with local customs which are generally regulated according to the usual terms of entry to farms viz: Lady Day (25th March) or Michaelmas (29th September) in England, and Whitsunday (28th May), or Martinmas (28th November) in Scotland..

The argument in favour of a spring rather than an autumn valuation is strengthened by considering the case of crops. At Michaelmas or Martinmas the crops will be largely harvested, and only a small part of the tillages for next season's crops will have been done. But only a small proportion of the crop will have been disposed of either by sale or by consumption on the holding, and the extent of the necessary valuation will be very great. With a spring valuation, on the other hand, the greater part of the previous season's crop will have been realised, and only the costs of the tillages etc., for the current season's crop will need to be determined.

As regards live stock and other classes of dead stock the balance is also in favour of a spring valuation since the stock breeder's year, as well as in many cases the stock feeder's, generally commences in the spring rather than in the autumn.

In any case it would be desirable to delay stock-taking until at least very little of the previous year's crop remains to be disposed of. It may, therefore, be generally recommended that on the average cropping, stock feeding, dairy or mixed farm the valuation for book-keeping purposes should be made at the most convenient date between Lady Day and Whitsunday. In regard to the hill sheep farm, however, the best date would fall between about the end of August and the end of September, that is, after the season's

crop of lambs, etc., has been sold off, and the breeding stock made up for the next season.

*The principles of valuation.* — Two leading principles in the valuation of stock of all kinds are enunciated by the writer, viz: 1) The values fixed must on no account be too high, that is, it should be possible at any time to realise the values put upon the stock. 2) Uncompleted articles of all kinds *e. g.* growing crops, young stock, etc., should be valued at cost of production up to date. Further, where it is not possible to fix the values automatically, that is, from cost-accounts, the valuation should be done by an independent party and preferably by the same party from year to year. Bearing these principles in mind, their application to the various classes of stock will be briefly examined.

a) *Crops.* — This section should give little trouble to the qualified valuer. Generally the basis of valuation should be *cost of production* up to date. With a spring valuation, the value would include the cost of the various tillages, seed, manure etc. whereas with an autumn one it would embrace summer cultivations and perhaps harvesting as well, along with a proportion of the yearly rent, rates and taxes. Hence the spring valuation entails much less labour, so far as growing crops are concerned.

Where cost accounts are kept, the values would be automatically determined in the respective crop accounts, but in the other cases (the great majority), and in any case for the first year or so, the cost of production would have to be estimated, per acre, for the various operations — ploughing, harrowing, drilling etc. In fact, it would be fairly accurate to keep the estimated cost per acre for each crop at approximately the same figure from year to year, although there would of course be differences in the number of acres of the various crops, which would affect the total value.

The advantages of a spring valuation are still more evident in the case of crops in stacks, pits, etc., (grain, potatoes, hay, straw, etc.) Their quantity in the spring is reduced to a minimum, thus the probable error which would occur in adopting the cost of production as the most rational method is much diminished. What generally happens, instead, is that the valuer fixes the values according to current market prices, or, it may be, on what is known as feeding or consuming value. So far as the consuming value basis is concerned, little objection can be taken from a purely book-keeping point of view, since the values are not likely to vary much from year to year. Not so with the market value basis, however, as neither farmer non valuer can foretell the price at which the crops will actually be sold, or indeed whether they will be sold at all. The result must be that the profit or loss shown after such a valuation has been made can be but a purely fictitious or paper one.

The writer asserts that by far the soundest method of dealing with the crops under such circumstances is to carry them foward at cost. *No real profit can possibly accrue from produce which is still in stock.* Regarding also the difficulty, in dealing with harvested crops, of estimating the *quantity*, the writer believes it a much easier way to take so many acres and value them at cost per acre.

*Live stock.* — With this class of stock also, the valuer would be well advised to base the valuations generally upon cost price, but there are certain important exceptions which must be dealt with differently, for the fundamental object is not to show what the farmer is worth, nor yet to show what capital is invested in the farm, but to assist in the determination of the actual profit or loss from the year's actual financial operation. It is this object which the valuer must keep primarily in view: it is only under special circumstances that the other objects mentioned become of first importance.

*Milk cows.* — On the strength of this principle, the milk-cows on the farm cannot be valued at market price, because the increase of value due to the increase of market price for dairy cattle can only give a purely fictitious profit, as the cattle would have to be sold for the profit to be actually realised and no profit would accrue from the dairy produce of the farm. The primary object of keeping an account for cows is to discover the profit (or loss) from milk production and *not* to show what profit *might* be made *if* all the cows were sold off.

The valuation on a cost basis is not applicable to such stocks for the reason that in a high class herd the values would come out lower than in a poor herd. The writer therefore fixes upon a third method, the "standard value basis" method, by means of which the average standard value of the cows in the herd is determined by calculating the increase in value of a 5 year-old cow, of good breed and quality, during the next two or three years, and then the decrease in value during the following three or four years, after which she is usually disposed of. In effect, the dairy herd should be looked upon as a factory for turning out milk (with calves as a by-product), the profit from which depends upon the price of milk, cost of feeding, labour, rent, etc., and only to very limited extent upon the market price of the cows themselves.

This method of valuation will apply more or less completely to all classes of breeding stock.

In referring to the valuation of cheese on the dairy farm, the writer believes no difficulty could arise as (if the valuation is made as suggested, in the spring) little cheese will be in stock, and in view of the extreme difficulty in accurately determining the cost of production it may be valued at a little under current market price.

*Other classes of cattle.* — Young dairy stock, home-bred. and purchased feeding stock, etc. should give little trouble and should almost invariably be valued on a basis of cost up to date, for here the *possibility* of a sale which might form a basis for valuation should be discarded for the *certainty* that the stock will only be sold when it is fattened.

*Horses.* — In the case of young horses not yet broken to work, the valuation should be on a cost basis, whether they are home-bred or purchased. The same principles apply as in the case of young cattle. Working horses, again, should not be valued at market prices but rather on the basis of an average valuation. The following method may be considered suitable: allow a certain figure as the value of an average three

year old filly broken to work. This may be called the " standard value " of three-year-olds, and should be such a value that the market value is not likely to fall lower, although it may be above the actual cost of production. In succeeding years it may be reckoned that the average horse will appreciate until a certain maximum is reached, after which depreciation may be allowed at a gradually increasing rate per annum until the horse stands in the books at, say, £ 2 at 18 years old. From a book-keeping point of view working horses are machinery, and should be treated strictly as such.

In valuing purchased working horses, consideration must be given to the purchase price and to any appreciation on depreciation in value since the date of purchase, but care should be taken that the valuation price is never higher than the market value, although it may well be lower.

*Other live stock.* — As regards sheep, pigs and poultry, these should be dealt upon exactly similar lines as for cattle.

*Machinery and implements.* — This class of stock should present no difficulty to the skilled valuer. At a first valuation, a detailed list must be made and approximate market value attached to each unit. Thereafter a certain rate of depreciation may be allowed upon the sum total. The rate of depreciation will depend chiefly upon the nature of the machine, the care taken in handling and storing it and its age. A detailed valuation should be insisted on at least every five years in order to ensure that the valuations are not too high. A limit of depreciation may be fixed for individual machines below which the value will not fall. The implements should be valued in groups according to the department with which they are chiefly concerned. Since the market value of this class of stock is very problematical, care should be taken to keep the valuation low enough.

*Other items in the valuation.* — Purchased seeds, manures and feeding stuffs will be valued at cost, plus the expense of bringing them to the farm. Tenant's fixtures (sheep-dipper, temporary buildings and fences, etc.) taken over by the previous tenant will be valued at cost, less depreciation at, say, 10 per cent per annum. There still remain two items, viz. farmyard manure and unexhausted improvements, both of which present some difficulty and involve considerable difference of opinion as to how they should be valued. As to farmyard manure, some hold that it should not appear in the books at all, but be treated as part of the soil which undergoes a certain cycle of changes from soil to soil. The writer, whilst admitting this position to be sound under certain conditions, believes it to be quite untenable where concentrated foods are being purchased and used in large quantities. On many arable dairying and stock feeding farms the yearly profit depends very much upon the skill shown in the production and utilisation of this commodity; it should therefore be considered in the farm accounts. As it appears to be hopeless to attempt to fix the cost of production per ton, or to put a market value upon it, the writer believes it best to fall back upon some arbitrary " standard value " for a certain quality, the figures which are used in valuations between outgoing and ingoing tenants being accepted as suitable for the purpose in view. When the valuation is made towards the end of

May, little farmyard manure may be in stock, as it may have been applied to the years' root crops. The only difference here is that the manure would be included in the cost of crops to date, instead of separately. The remaining item may on a well managed farm be one of the most important assets. It includes the unexhausted value of such improvements as drainage, laying down permanent and temporary pasture, application of farmyard manure and certain artificials and consumption of feeding stuffs. Under the Agricultural Holdings Act, the unexhausted parts of such improvement have now a more or less definite market value, which must be based very strictly upon their value to an ingoing tenant, and this must be kept in mind by the valuer in assessing the amount lest a value be given to this asset which cannot be realised at the end of the tenancy, the only time it can be realised except indirectly by gradual exhaustion. In this case one has to follow the custom of the district in regard to outgoing valuations, and after the necessary preliminary assumptions have been settled the method is simple and should give little trouble to the valuer and book-keeper. The determination of these assumptions being, however, a difficult matter, and beyond the limits of the present discussion, the writer restricts himself to giving an example by way of explanation and concludes that two points should be noticed. In the first place that other items may also appear in the valuation, *e. g.* " acclimatisation value " on hill sheep farms, especially in Scotland, the " tenant right " on Ulster farms ; and the " goodwill ' on milk retailing farms.

These rules for compiling the annual inventories serve equally for the tenant and for farm owners ; in the latter case, of course, the value of the farm would be an important item in its valuation.

## AGRICULTURAL INDUSTRIES.

555 - **A Practical Method for Removing the Strawberry Flavour from Noah-grape Wines.** — DEGANS C. in *Le Progrès agricole et viticole*, Year 33, No. 10, pp. 226-227. Montpellier, March 5, 1916.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

The principle adopted consists in deodorising the must by removing the lees (which contain the ethers that give the characteristic aroma to wine) and in consequence the ferments ; then start the fermentation by means of the must of grapes possessing a pleasant flavour and smell.

To the pure, unfermented juice as it came from the press were added 24 to 32 oz. of potassium metabisulphite per 100 gals. of juice so as to completely inhibit any fermentation. The must, immediately decanted into the vat had, in about 12 to 15 hours, deposited all the lees; it was then placed in the casks and fermented by adding from 5 to 10 % of active must from grapes lacking the strawberry flavour. After fermentation, the unpleasant flavour was quite gone. This method is applicable on a small scale. In large establishments the must to be deodorized should be filtered as soon as it comes from the press, and to this clear liquid, now free from ferments, should be added the must of the grapes possessing no strawberry flavour.

556 – **The Ferments of Pineapple Wine.** — FOUQUÉ HENRI in *Comptes-Rendus hebdomadaire des Séances de l'Académie des Sciences*, Vol. 162, No. 12, pp. 433-435. Paris, March 20, 1916

Some pine-apple juice, obtained by crushing the fruit, was placed in sterilized bulbs in some of which air was present, while in others as high a vacuum as possible was produced. The juice was then left to ferment spontaneously at a temperature of 28-30° C. By successive inoculation of nutrient gelatine, the writer was able to isolate from the first bulbs three yeasts *a*, *b* and *c*, and from the second, three yeasts *a*, *c* (identical to the previous yeasts) and *d*. The most important among these yeasts is *d*. The two yeasts *d* and *b* belong to the genus *Saccharomyces*, while *a* and *c* are doubtful ferments intermediate in character between *Mycoderma* and *Torula*, with very weak fermentative action, yet not hindering, at least at high temperature, the fermentation of the pineapple juice. The action of yeast *d* does not appear to be favoured or complemented by the action of the other three yeasts.

557 – **Waste Waters from Potato-starch Factories in Hungary; their Noxious Action and Purification** (1). — HALMI J. in *Vizügyi Kozlemények*, Year VI, Part 1, pp. 1-22, Budapest, January-February 1916.

This study contains the following chapters: I. A short description of the manufacture of potato-starch. — II. Quantity, kind and composition of factory waste waters. — III. Noxious action of these waters. — IV. Processes for purification (mechanical, chemical, biological).

In Hungary the fish industry has often suffered from the waste water coming from potato-starch factories; the object of this work is therefore to discover some means of improving previous methods of purification.

There are at present 24 firms manufacturing potato-starch in Hungary with 27 work-shops, 13 of which use potatoes; 6 maize; 2 wheat; 1 rice; 2 alternately wheat, rice and maize; 1 potatoes and maize; 1 potatoes and wheat; 1 maize and wheat. According to the statistics compiled by the National Hungarian Society of Manufacturers of Chemical Products for 1910, the 13 large potato-starch factories produce annually 354 240 cwt. of starch; the small ones 9840 cwt. In favourable conditions this production requires at least 2 558 400 cwt of potatoes. From the data collected at the factories by SAARE, DAMMER, WEIGELT, PAROW, KÖNIG and FISCHER, the average volume of waste water from the factories may be calculated, at 1.4 to 2-8 cub. ft per cwt. of potatoes, according to the methods of manufacture. The amount of waste water that the factories annually run to waste would thus be from 43 912 100 to 91 824 200 cubic feet. The damage caused by these waste waters is sufficiently serious, when it is considered that the entire working period of the factories does not exceed 3 or 4 autumn-winter months and that the expulsion of all this quantity is performed in about 100 days. The factories therefore evacuate daily during the period of activity from 459 121 to 918 242 cubic feet of waste water.

In previous purification experiments the best results were obtained by

(1) See *B.* Feb. 1915, No. 211; *B.* Jan. 1916, No. 92.

(*Ed.*).

irrigation; but, to be successful with this method only 2106 cub. ft. of waste water per acre should be treated per day. Considering that the large factories furnish daily 706 340 cub. ft. of waste water, 430 acres would, according to the preceeding data, be necessary for the purification of such a volume of waste water. But to avoid stagnation, the irrigated land needs if possible a year's rest, and this means that the factories would be obliged to dispose of 860 acres (about 64.25 acres per factory) plus drains and with sufficient filtering power. This method was disproportionately expensive and for this cause was abandoned by the factories in favour of a mechanical system of purification.

The writer reviews the different methods used for studying the purification of waste water (DEGENER, ROTHE, SCHÜTZ, KÖNIG, ROLANTS, SAARE, GAULTIER DE CLAUBRY, ELSÄSSER, DAMMER, CALMETTE, ZAHN) and points out the defects in several. In Hungary the good results obtained from trials have given rise to a system which is based on the following principles: 1) purification of the water in which the potatoes are washed by decantation; 2) accumulation in special ditches of the noxious waste water obtained in the different manufacturing operations, and their emptying after fermentation. This way of solving the problem of the purification of waste water has given the most satisfactory results and is much more economical than either the method by dilution or the artificial biological method.

The various methods for applying this method may be summarized as follows:

Small factories working daily two wagon-loads, that is nearly 400 cwt. of potatoes, require per wagon 0.33 gals of water per second. The water required increases in proportion to the size of the factory. Those working daily 20 wagon loads (200 tons) of potatoes need per wagon 0.55 gals per second of water, that is 11 gallons per second for 20 wagons. The volume of waste water ejected corresponds, naturally, to the amount used in the manufacturing operations. Two thirds of this quantity may be considered noxious; the other innocuous third consists of the water in which the tubers are washed.

The innocuous water should be run into a tank of sufficient capacity to contain not only the deposit formed by the water during the whole period of the factory's activity, but also the waste water itself, which therefore should be run through the tank at a speed of 5 mm. per second. The deposit generally amounts to 5 per cent of the material worked, that is 25 cub. ft. per wagon. The tank should be divided into several sections allowing of separate repairs. A kind of wire sieve with openings not above 2 cm. wide should be applied at the mouth of the tank to retain the potato fragments. To clear the water from any floating matter, a board or beam is laid across the exit opening of the tank. When all earthy matter is deposited at the bottom of the tank and all the floating matter is held back, the purified water can be led into any water course without risk.

The waste water voided during 100 to 120 days of work (for small factories working 2 wagons of potatoes a day (say 706 000 cubic feet);

for large factories working 20 wagons a day (about 12 219 682 cub. ft) should be run over diked areas of ground with no outlet and there left. The water should be about 3 feet deep ; in this case the area needed by small factories will be about 5 acres, and for large factories 85 acres. The noxious waste water will then evaporate and filter of its own accord, what remains is allowed to ferment and only when fermented allowed to run into other water courses. The authorities of the Water-supply Department fixes in each case the period of release of the purified waters. In the Hungarian climate, fermentation is completed after 4 months. The soil manured with the deposit of noxious waste water can be utilized for cultivation. The authorities are favourable to factories which desire larger areas in view of enlarging their industry. This simple and economical method has been adopted with success by several factories, and appears to be as much adapted for general use as any of the other methods considered by the writer.

558 – **Raisin Making in California; Influence of Ripeness on the Returns.** — *Annual Report of the College of Agriculture of the University of California*, Year 1915, p. 32, Berkeley Cal. 1915.

BIOLETTI has shown the advisability of harvesting raisin grapes at a more advanced stage of ripeness that is usually done.

The crop of Muscat raisins at Kearney increased 48.3 per cent between August 12 and September 23, making a net cash profit of 75.9 per cent.

The increase at Davis from August 26 to September 23 was 12 per cent in crop and 18 per cent in net profit. The increase in Sultaninas from August 5 to October 1 at Kearney was 34.1 per cent in crop and 47.9 per cent in net profit.

Much of this increase is often lost by harvesting the grapes too early. It could not all be saved for two reasons : 1) It is practically impossible to gather all the crop at the advanced stage of ripeness corresponding to the maximum crop ; and 2) raisins made from the ripest grapes, while of the best quality for eating, are too "sticky" for the usual methods of handling in California. If the beginning of harvest were deferred until the Muscat showed 25° Bal. — the average would be about 26° Bal. for the whole crop — the crop would be of excellent quality and much larger than is usual now. Observations in six Muscat vineyards near Fresno indicated a loss from too early picking of from $ 12 to $ 22 per acre, or $ 16 as an average for all.

The time required for drying increased in one experiment from 13 days for Muscats gathered August 17, to 34 days for those gathered September 16. The number of pounds of grapes required to make a pound of raisins decreases with advancing ripeness. The tests made indicate that 3.4 should be a minimum for Muscat and 3.8 for Sultanina, and a favourable average 3.2 for the former and 3.6 for the latter. Higher ratios indicate insufficient ripeness or losses in handling.

559 - **The Determination of Citric Acid in Milk.** — KUNZ RUDOLF in *Archiv für Chemie und Microskopie*, Year VIII, No. 4, pp. 129-133. Vienna, 1915.

Previous study on the citric acid content of wine, suggested the possibility of employing STAHRE's test for the estimation of the citric acid in milk. Subsequent experiments have shown that it is possible to adopt this method by proceeding as follows: into a 200 cc. beaker pour 50 cc. of milk and 10 cc. of sulphuric acid diluted with an equal volume of water; add 2 cc. of a 40 % solution of potassium bromide and 20 cc. of a solution of phospho-tungstic acid; make up to 200 ccs. with distilled water, then shake and filter. Pour 150 cc. of the filtrate into an Erlenmeyer flask and add 25 cc. of a freshly prepared saturated solution of hydrobromic acid. Heat the flask on a water-bath at 48-50° C. for 5 minutes, then gradually add 10 cc. of a 50 % solution of potassium permanganate, shaking the mixture continually. For the remaining operations, proceed as in the case of the estimation of wine. To determine the amount of citric acid contained in 100 cc. of milk, multiply the weight of the pentabromacetone obtained by 1.215.

By this method the citric acid content of several kinds of milk has been ascertained. The following table gives some of the results obtained:

*Quantity in grams of the citric acid content of* 100 *cc. of various samples of milk.*

| | | Citric Acid |
|---|---|---|
| 1) Milk from a Vienna dairy | | 0.169 —0.170 |
| 2) Fresh milk direct from a healthy cow | | 0.1985—0.1986 |
| 3) Milk from a cow | at the beginning of milking | 0.1980 |
| | at the middle " " | 0.1992 |
| | at the end " " | 0.1806 |
| 4) Milk allowed to curdle naturally | fresh milk not acid | 0.1707 |
| | milk slightly curdled | 0.1206 |
| | milk completely curdled | none |
| 5) Yoghurt | fresh | 0.1668 |
| | after standing 24 hours | 0.1682 |
| | after standing 48 hours | 0.1670 |
| | after standing 72 hours | 1.1648 |

From these results the following conclusions may be drawn:

1) The milk is richer in citric acid at the beginning and middle of milking than at the end.

2) In ordinary milk, the citric acid content diminishes progressively as the milk becomes sour.

3) Yoghurt is fairly rich in citric acid, which does not decrease even on keeping.

The conclusion is that by STAHRE's method the estimation of citric acid in milk can easily be carried out.

560 – **On the Resistance of Non-Sporing Bacteria in Milk to the Action of Heat.** — GORINI COSTANTINO in *Rendiconti del Reale Istituto Lombardo di Scienze e Lettere*, Series II, Vol. XLVIII, Part XVIII, pp. 956-961. Milan, November 25, 1915.

It is admitted that sporing bacteria are the most resistant to the action of heat and the fact that other non-sporing bacteria are resistant to an unusual degree is attributed to the existence of particular races possessing a higher resistance to heat.

As it was observed that milk soured after sterilization contains non-sporing forms, it was thought that this might be due to some special protective influence similar to that protecting pathological organisms. Experiments have shown that the protection is due to the formation of a covering of casein, caused probably by the biochemical action of the bacteria themselves, before or during sterilization. Thus the explanation of the apparent resistance of non-spoiing bacteria to the action of heat is more comprehensible.

It is therefore necessary to find out if this exceptional thermo-resistance is a permanent character, common to the majority of individuals of a given bacterial race, or whether it is rather a protective phenomenon similar to that observed in milk. An observation of practical importance is that in none of the experiments made, was any case found of resistance to heat above 85° C., and no bacterium, even when artificially covered with casein, ever suvived 90° C., whilst under normal conditions the bacteria resist sterilization temperatures of about 100° C. As the surviving bacteria, however, are localised in small clots of casein and have acid-coagulating properties, the difference is attributed by the writer to the unavoidable difference between natural and artificial conditions, which do not, however, affect the theory that the thermo-resistance is due to the protective influence of the coat of casein formed round the organisms.

561 – **Experiments in the United States Upon the Digestibility of Some Animal Fats.** — LANGWORTHY C. F., and HOLMES A. D. (Office of Home Economics) in *U. S. Department of Agriculture Bulletin* No. 310, pp. 22, Washington, November 9, 1915.

Notwithstanding the fact that fats are ordinarily one of the principal sources of energy in the diet and are 2 ¼ times as effective for this purpose as either protein or carbohydrates, their use in the diet has received less attention from investigators, and is consequently less perfectly understood than that of other nutrients.

It has generally been taken for granted that fats are thoroughly assimilated when eaten in favourable combinations, and that the different kinds do not vary enough in this respect to affect materially the amount of energy the body derives from them. The recorded experimental data, however, are not conclusive on this point. Experimental data are also very limited on another point — the relation of melting point to thoroughness of digestion, particularly with regard to fats of high melting point. It seemed therefore desirable to study the digestibility of the more common culinary and table fats prepared in a similar manner and incorporated in a uniform basal ration.

The experiments described in this article were made with beef tallow,

mutton tallow, lard and butter. The digestibility was estimated from the weight and the analysis of the faeces. The total amount of the ether extract of the faeces did not, however, represent the actual quantity of undigested fat, but also contained metabolic products soluble in ether (bacteria, digestive juices, internal secretions and epithelial cells of the stomach and intestines). In order to determine these, the writers made 34 experiments with the basal ration without added fat. They determined the metabolic products present in the ether extract of the faeces and found that their quantity was equal to that obtained by the use of the basal ration when fat was also given.

*Comparison of Digestibility and Melting Point.*

| Fat studied | Coefficient of digestibility | | Melting point | |
|---|---|---|---|---|
| | Determined | With allowance for metabolic products | Writers' determinations | Compiled average values (1) |
| | Per cent | Per cent | Degrees C. | Degrees C. |
| Butter fat | 94 | 97 | 32 | 28–36 |
| Lard | 94 | 97 | 35 | 30–44 |
| Beef fat | 89 | 93 | 45 | 42–50 |
| Mutton fat | 80 | 88 | 50 | 47–49 |

(1) *Allen's Commercial Organic Analysis.* Philadelphia, Blakiston's Son and Co., 1910, 4th ed., Vol. 2, p. 72.

The average amount of water-free faeces occurring as metabolic products in the ether extract was 9.98 per cent. The coefficients of digestibility were calculated as follows.

9.89 × (weight of water-free faeces) = metabolic products. (Total ether extract) — (metabolic products) = unutilised fat. (Utilised fat) ÷ (total fat eaten) = per cent of digestibility.

All the fats included in this series of experiments were well-assimilated (for coefficients of digestibility see accompanying Table). The average amounts of fat eaten per subject, per day, during these experiments were 90 gr. of lard, 100 gr. of beef fat, 53 gr. of mutton fat and 100 gr. of butter. The average amount of protein consumed daily by the subjects was somewhat lower than that specified in dietary standards, but it was not considered essential to maintain any special nitrogen level. The values for the digestibility of the carbohydrate content of the diets varied from 96 to 97 per cent. The average energy value available per man per day, as calculated by the ordinary factors and the coefficients of availability found in the digestion experiments was, 2 235 calories for the lard, 2 730 calories for the beef fat, 2 145 calories for the mutton fat and 2 420 calories for the butter diet.

The average coefficients of availability of energy for the rations as calculated were : 93 per cent for the rations containing lard ; 92.7 per cent for the rations containing beef fat; 91.5 per cent for the rations containing mutton fat ; 93.9 per cent for the rations containing butter. These values agree with one another closely and are somewhat higher than the value 91 per cent which has been found to represent the coefficient of availability of energy of the ordinary mixed diet (U. S. Experiment Station Bulletin 136, 1903, p. 113). It is reasonable to conclude therefore, that the different fats did not exercise any unusual effect upon the digestibility of the other constituents of the rations. The accompanying Table allows of a correlation being established between the digestibility of fats and their melting point.

It seems fair to conclude that, of those tested, the fats of low melting point are capable of more complete assimilation than those which have a high melting point.

The variation in the melting point of different samples of the same fat is consistent with the view that the melting point differs with the part of the body in which the fat is found, and also with the animal from which it is taken.

562 - **Spanish Wools.** — *La Industria Pecuaria*, Year XVII, No. 510, pp. 526-529. Madrid, March 10, 1916.

Among European countries Spain is still, besides Portugal and Turkey, the most important exporter of wool. In the last three years in which the market conditions were normal, that is 1911-1913, the Spanish wool commerce was the following :

| | Imports | | | Exports | | |
|---|---|---|---|---|---|---|
| | 1911 | 1912 | 1913 | 1911 | 1912 | 1913 |
| Unwashed wool .. lb. | 210 052 | 314 292 | 270 980 | 23 640 192 | 24 106 278 | 30 336 625 |
| Washed wool .... lb. | 2 140 596 | 2 378 904 | 1 585 824 | 855 419 | 9 114 035 | 1 953 8 .9 |

The most valuable portion of the Spanish wool production is given by the crossbred flocks descending from the old and famous Merino flocks (Infantado, Curiel, Hinojosa, del Paular, de la Huelga de Burgos de la Cabaña Real Española, etc.) the historical stocks have, however, in more than one case been intermixed, thus modifying their type. The present Spanish Merino wool, elastic, wavy, spongy and resistant, which, (especially that of some flocks) competes in fineness with those of the same, quality in France, Germany, Africa and Australia, is not so long as some of the best of those and rarely has the evenness acquired through the constant selection practised, especially by the Australian breeders.

Spanish wools may be classified as follows: 1) *"Fine" merinos.* — Wools from Estremadura, part of West Andalusia, and principally from Comarca, La Serena ; also the quality named after Valle Alcudia, and the wool sheared in Castile during the spring migration of the flocks to the mountains

2) *"Semi-fine". merinos* — From the Andalusian Merino, a cross between Merino and the short fleece sheep ("rasa") which inhabits the most fertile parts of Andalusia.

3) *Short wool.* — From the sheep of Aragona and Mancha, etc., amongst which may be distinguished for fineness the variety "fina de Aragón" and the variety bred in the provinces of Cuenca, Toledo and Ciudad Real.

4) *Wool from the "churra" sheep (giarrosa).* — In large, resistant, shiny flocks ; although it lacks fineness it is good for spinning and is preferable for certain uses to the Australian twined wools. It comes from the mountains of Burgos and some parts of Estremadura and Andalusia, the plains of New Castile and the environs of Madrid.

5) *"Hacha" wool.* — From a part of Navarre and from the province of Vascongadas : the production is of small importance,

6) *Black Merinos.* — In the writer's opinion this breed, which belongs exclusively to Spain and the neighbouring zone of Portugal, is not worth preserving. It descends from the most ancient Spanish race of sheep and from the colour of its fleece shows a marked relationship to races occurring in hot countries.

The prices of Spanish wools for the last two years per "arroba" of 25.3 lbs. were as follows :

*Prices of Spanish Wools during* 1914-1915.

| Origin of Quality | 1914 | | | | | | 1915 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Minimum | | | Maximum | | | Minimum | | | Maximum | | |
| | $ | s. | d. | £ | s. | d. | £ | s. | d. | £ | s. | d. |
| Valle de Alcudia | | 19 | 9 | 1 | 2 | 0 | 1 | 3 | 9 | 1 | 8 | 6 |
| Cabeza del Buey e La Serena | 1 | 1 | 0 | 1 | 2 | 6 | 1 | 6 | 2 | 1 | 11 | 8 |
| Black merinos | | 13 | 10 | | 14 | 5 | — | — | — | 1 | 0 | 2 |
| Cordova | | 16 | 7 | | 19 | 9 | 1 | 1 | 9 | 1 | 4 | 9 |
| Seville « Semi-fine » | | — | — | | 17 | 7 | | — | | 1 | 3 | 9 |
| « Rasa » wools | | 16 | 7 | 1 | 0 | 2 | 1 | 1 | 9 | 1 | 6 | 2 |
| « Churras » wools (prov. of Madrid) | | 15 | 0 | | 15 | 10 | | 19 | 9 | 1 | 1 | 4 |

563 – **Methods for Testing Fumigated Cocoons.** — COLOMBO GUIDO in *Informazioni Seriche*, Year III, No. 4, pp. 61-68, Rome, February 20, 1916.

The injurious action caused by fumigating cocoons with formalin, chlorine, hypochlorous acid and sulphurous acid, in order to destroy *Botritis Bassiana,* has made it necessary to attempt to find methods suitable

for the control of cocoons bought by silk manufacturers at the time of the harvest. In testing for formaldehyde, the method, long used by the Laboratory for Studies and Experiments on Silk (Padua, Italy), is that based on the formation of a more or less intense blue colour, when the silken covering of a cocoon, previously exposed to formalin vapour, is dissolved in concentrated hydrochloric acid (1).

For testing chlorine fumigations, now almost entirely given up on account of breeding, iodine tests are usually employed, or the chlorides in the extracted ash are determined.

For fumigations with sulphurous acid, more often used by the breeder, tests have been found to be more difficult. The acid was estimated by precipitation of the $H_2 SO_4$ obtained by treating the cocoon with alkaline water, all organic matter having been previously destroyed.

This determination, besides requiring at least a whole day, cannot be done conveniently, save in a chemical laboratory.

An attempt has been made to shorten the time required for testing the fumigated cocoons, by means of volumetric methods.

Direct titration with decinormal caustic potash and phenolphtalein could not estimate the very small quantity of $H_2 SO_4$ present in the silks. Among methods of indirect titration, one based on the use of a dilute solution of disodium phosphate offered many advantages, and was therefore adopted and extensively tested. Results were obtained giving an average of about 65 % of the sulphuric acid present in the silk.

This method enables suspected cocoons to be sorted out rapidly and accurately, those being included which, according to the table of rules compiled for analysis by the writer, are included between the amounts 1.90-2.10 cc. of $\frac{KOH}{10}$ necessary to neutralize 150 cc. of liquid extracted from 10 gr. of fresh cocoons on the one hand, and 2.00-2.20 cc. of $\frac{KOH}{10}$ (dried cocoons), on the other. As a general rule drying much diminishes the delicacy of the test.

564 - **Industrial Value of Japanese Yamamai and Sakusan Silks; Experiments in Italy.** — SEVERINI F. in *Informazioni Seriche*, Year III, No. 5, pp. 97-103. Rome, March 5, 1916.

The writer was charged by the Ministry of Agriculture, Industry and Commerce to examine several samples of Yamamai silk (*Antheraea Yamamai*) and Sakusan silk (*Antheraea Perny*) coming from the "Cooperative Society for the Yamamai and Sakusan Silkworm industry" of Nan-Boku, Adzumigori in Nagano Ken, Japan.

The experiments have shown that Yamamai silk has more brilliancy than European silks, but the difference is not such, even considering this

(1) This colour reaction must not be mistaken for the well known reaction given by albuminoids dissolved in concentrated hydrochloric acid, which appears much more slowly, is less intense and has a decidedly violet tinge. (*Ed*).

special quality, as to constitute a decided superiority even for the latest styles.

Furthermore, the high price (£ 2.13 s. per lb.) is in itself an obstacle to the introduction of this silk into European weaving, even were it to fall considerably.

In all the tests made, Yamamai silk proved inferior to the mulberry Bombyx in many points essential for widely used silken articles, and not to be compensated for by any superior elasticity.

For specially strong and elastic textures, Yamamai silk would, on the contrary, be an excellent material, as is shown by the tests for strength and elasticity made by the writer. Sukusan silk proved slightly superior for weaving to the Chinese Tussah silk, and may perhaps be preferred to it in the European markets.

565 – **Decree Regulating Butter Manufacture and Trade in Brazil.** — *Revista de Veterinaria e Zootechnia, Publicação official do Serviço de Industria Pastoril do Ministerio da Agricultura, Industria e Commercio*, year V, No. 6, pp. 262-264. Rio de Janeiro, December 1915.

AGRICULTURAL PRODUCTS: PRESERVING PACKING TRANSPORT TRADE

Decree Nº 3070, dated December 31, 1915, establishes that :

The name "*butter*" applies to the product obtained by churning cow's milk or cream, sweet or sour, free as far as possible from washing water and whey, containing or not containing chloride of sodium of suitable purity. Innocuous vegetable colouring substances may be added for a period of two years from the issuing of this decree. The manufacture and sale of butter obtained from the milk of other domestic animals is allowed, on condition that its origin be declared and that all the sections of this law be observed. Butter is considered adulterated when it contains less than 80 % of fatty matter or has more than 15 degrees of acidity (normal alkaline solution in cubic centimetres necessary to neutralize the free fatty acids contained in 100 gr. of fatty matter). — The sale of preserved or renovated butter (melted) is permitted on condition of its being declared as such. The sale of products similar to butter in appearance and use but of a different nature, is prohibited if they are described as butter. A reliable indicator must be added to margarines. The name, trade-mark, locality and weight must be declared on the wrappers of all fresh, preserved or melted butter, or its substitute.

The Government can institute official marks of guarantee both for fresh butters or preserved and renovated butters.

Offenders will be fined up to the maximum of 1 *conto de reis* (£ 114) and the penalty will be doubled for a second offence.

# PLANT DISEASES

## DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

566 – **Injury Caused to Vegetation in Grounds near Ironworks at Terni Italy.** — AMPOLA G. and VIVENZA A., in *Annali della R. Stazione chimico-agraria sperimentale di Roma*, Series II, Vol. VIII, pp. 139-164. Rome, 1916.

The grounds where vegetation has been harmfully affected are situated in close proximity to the Steel-works, and especially to two Martin N° 2 furnaces with two chimneys about 160 ft. high, and to a third smaller chimney belonging to some gas-works. The land is so situated as to receive all the smoke and gaseous products passing away from the chimneys. The clayey-calcareous soil is not favourable for the growth of pasture but is suitable for trees and bushes, especially vines, with which it is thickly planted, as well as with fig, apple, pear, apricot, peach, cherry, nut and olive.

Inspections were carried out at different times (spring, summer and autumn 1914) so as to observe the different stages of growth of the trees.

The following facts were ascertained : The vine suffers most among the woody species, about 20 % of the vines being either totally killed or withered down to the base of the stock. Some of the vines presented a miserable appearance ; most of them were weak, with pale or shrivelled leaves and bore no fruit ; some few bore imperfect bunches of fruit ; finally, some, though weakened, bore grapes of an almost normal appearance. The vines still remaining in fairly good condition were not more than 25 % of the whole number and belonged to the varieties : " canina ", " bottafemmina ", and " menaiolo ". The varieties that were most affected were : " martone ", " verdetto ", " malvasia ", " moscetta ", " aleatico ", etc. At vintage time, the reducing sugar content of the must was 14.6 %, and the total acidity 10.5 % ; while normally the reducing-sugar content of the must in that region is 17 %. The effect of two distinct injurious actions have been observed on the vines :

1) a general decline of vegetative power consequent on previous years of disease, and perhaps of continued toxic action, characterized by stunted development of the branches, short internodes, abundant production of false-shoots, and small pale or reddish leaves.

2) scorching of the leaves, especially at the apex and round the margin, appearing suddenly from time to time. The macroscopic and microscopic examination of the scorched organs showed the characteristic effects of burning by hydrofluoric or sulphurous gases. Even ligneous plants such as the fig, apricot, peach and nut, are injured more or less seriously; pear, apple, cherry, elm and olive suffer much less; mulberry does not appear to suffer any harm, (the leaf, however, is not given to silk-worms for fear it may be injurious); willow, poplar, oak and hazel are perfectly unharmed. The damage caused to grasses (cereals, forage, and garden plants) are unimportant or nil.

According to the chemical composition and amount of the combustibles (coal and Spoleto lignite) consumed daily by the Steel Works, it is calculated that the chimneys pour out daily at least 12,019 lbs, equal to 65,791 cubic feet of sulphurous anhydride. In the air over the grounds in question 0.00048 gr. of sulphurous anhydride were found per cubic foot of air, on a day when the works were most active, and 0.00034 gr. per cubic foot of air on a day when their activity was less.

The determination of sulphuric acid and fluor in the leaves of the injured plants and in the must (many workers affirm they never have discovered any fluor either in the genuine wines or the very numerous varieties studied) gave (for dry matter) the following results:

| | Sulphuric acid % |
|---|---|
| Fig-leaves gathered June 25: sound | 0.20 |
| injured | 0.46 |
| " " " August 29: sound | 0.24 |
| injured | 0.45 |
| | **Fluor %** |
| Fig leaves: sound | 0.003 |
| injured | 0.015 |
| Vine leaves: sound | 0.002 |
| injured | 0.019 |
| Must . . . . . gr. per litre | 0.010 |

The writers conclude that on the property they have investigated, the vines and apricots are destined to almost totally perish within a few years; figs and peaches will also for the most part die out.

567 – **Mosaic Disease in Beets.** — Lind Ji in *Tidsskrift for Planteavl*, Vol. 22, No. 3, pp. 444-457. Copenhagen, 1915.

In addition to an explanation of the nature of mosaic disease as it is best known among tobacco plants and other *Solanaceae*, the author gives a description of the special form found attacking *beets*. Hitherto it would appear to have aroused but slight attention, as it is only known from Den-

mark (since 1899) and a few other places, chiefly Southern Sweden, the North of France and Berlin. In Denmark the disease is general among beets, and causes great ravage among the seed crop, but is never found in sugar beets. There was no difference whatever between the seed of plants attacked by mosaic disease and that from healthy plants sown under identical conditions ; on the other hand, the rows which stood nearest to some beets severely attacked by mosaic disease were themselves attacked. The disease showed a considerable diminution, the greater the distance from the source of infection ; at about 18 ins. from the affected seedling beets, 100 per cent of the sown beets were affected by mosaic disease, but at a distance of about 10 feet only 10 % were attacked in July. Later on in the autumn the disease spread over a radius of more than 200 yards from the parent beets. It is most likely that aphides and other insects spread the disease. Beets attacked by this malady in June grow to only half the size of healthy plants, while the parent beets affected by the disease only yield ⅓ of the seed produced by healthy plants.

The experiments yielded the following results :

1) Mosaic disease of beets is not conveyed by the seed, but is transmitted under field conditions by the parent beets to those of the first year.

2) The virus of the disease occurs in the sap of leaves attacked by mosaic disease and cannot penetrate the plants save through lesions or through young or immature parts of the stem and leaves.

3) Mosaic disease results in a smaller crop. With first-year beets, which are infected through the veins of the leaf, the diminution of crop may amount to 30 % say about 159 cwt to the acre.

4) The disease can be prevented by only choosing healthy parent-plants for transplanting in the following year, and lifting them with disinfected implements.

The article contains, as appendix, a bibliography of 17 works.

## DISEASES DUE TO BACTERIA, FUNGI AND OTHER LOWER PLANTS.

GENERALITIES

568 - **Report on Diseases of Agricultural Plants in Denmark, in 1914.** — Lind J. Rostrup S. and Kölpin Ravn in *Tidsskrift for Planteavl*, Vol. 22, pp. 267-295. Copenhagen, 1915.

Many of the diseases mentioned are the same as those of previous years. We can specify the following new observations: yellow-point-disease attacks *Avena sativa* in many parts of Jutland ; it is distinguishable by the presence of dead leaf-ends. The disease is encountered most frequently on soil which is poor in nutritive properties in low- lying districts, and it would appear to be of a physiological nature. Turnips were violently attacked by *Erysiphe communis* in plots which had been well dressed with lime, but not on the experimental plots close by which needed a similar dressing. The leaf-roll disease of potatoes would appear to be dependent

upon the quality of the soil; in some districts potatoes can be cultivated without being affected by this disease which causes the leaves to roll up, whilst in other parts they become so diseased after a year or two that the crop falls off materially, and the growers are forced to get fresh seed-potatoes from other districts.

A new disease of the stalks has been observed in *Medicago sativa*, which is due to *Marssonia Medicaginis*. As an remedy for « Dörrfleckenkrankheit » manganous sulphate is used with good results, and is now employed to control this disease both in mangolds and oats.

Among noxious animals *Arvicola agrestis*, *Heterodera schachtii* var. *avenae*, *Oscinis frit*, *Silpha opaca* and especially *Plutella cruciferarum* have been very destructive.

569 - **The Study of the Diseases of Cultivated Plants in India.** — See No. 488 of this *Bulletin*.

570 - **New Fungi in Saxony (Germany).** — BRESADOLA G. in *Annales Mycologici*, Year 13, Vol. 2, pp. 104-106. Berlin, 1915.

Amongst the new fungi enumerated by the writer, the following are worth recording: 1) *Phyllosticta Menthae* Bres. n. sp., on the leaves of *Mentha arvensis*; 2) *Phoma lupulina*, on the stems of *Medicago lupulina*; 3) *Gloeosporium roseolum*, on the leaves of *Acer platanoides*; 4) *Gl. acerinum* West. var. *samaricola* on the same host-plant; 5) *Septogloeum Pastinacae* Bres. n. sp., on the leaves of *Pastinaca sativa*; 6) *Cylindrophora Fagi* Oudem. var *candida*, on the branches of *Pinus sylvestris*; 7) *Macrosporium Papaveris* Bres. n. sp., on the leaves of *Papaver somniferum*; 8) *Rhabdospora Lappae* on the stems of *Lappa officinalis*. The writer was not able to determine whether this fungus was identical with *Phlyctaena Lappae* Sacc. On the stems of *L. officinalis* a *Rhabdospora* with straight spores is found (*Rh. lusatica* Feurich n. sp.)

571 - **A Contribution to the Knowledge of Dalmatian Fungi** (1). — JAAP OTTO in *Annales Mycologici*, Vol. XIV, No. 1-2, pp. 1-44. Berlin, 1916.

The writer enumerates 510 species of fungi which he himself and others collected in Dalmatia during 1914; of these, 50 are new to science. The most worthy of mention are: 1) *Calonectria Gymnosporangii* Jaap n. sp., on *Gymnosporangium confusum* and on the branches of *Juniperus phoenicea* and of *J. Oxycedrus*; 2) *C. Höhnelıana* Jaap. n. sp. on the stems of *Ruscus aculeatus*; 3) *Guignardia istrica* Bubák n. sp., on *Ruscus aculeatus*; 4) *Mycosphaerella saccardoana* Jaap. n. sp. on old leaves of *Juglans regia*; 5) *M. Unedinis* Jaap. n. sp., on living leaves of *Arbutus Unedo*; 6) *Entyloma Pastinacae* Jaap. n. sp., on living leaves of *Pastinaca sativa*.

572 - **A Contribution to the Biology of *Plenodomus fuscomaculans*, Injurious to Apple Trees.** — COONS GEORGE HERBERT in *Journal of Agricultural Research*, Vol. V, No. 16, pp. 713-769. Washington, D. C., January 17, 1916.

This paper gives the results of experiments performed with *Plenodomus fuscomaculans*, a fungus parasitic on the apple. The specific pro-

(1) See, *B.* March 1915, No. 324. (*Ed.*).

blem undertaken was the determination of the effects of various controlled environmental factors upon the growth and reproduction of this fungus.

A brief retrospective glance of the historical development of the art of culturing organisms, from the first crude cultures to the present elaborate technique, and the simultaneous development of our knowledge of the physiology of organisms, shows that the environmental factors may greatly influence the life processes of the fungus in question. This *Plenodomus* was found to have a wider range of suitable conditions for growth than for reproduction.

Light may be, in certain special cases, a decisive factor in the formation or non formation of pycnidia, which cannot be formed in the dark. The formation of fruiting bodies begun in the full light may, however, continue even in the absence of light though with a limited intensity.

There is therefore an inverse relation between growth and reproduction, insomuch as a strong light inhibits the normal development of mycelium.

The pycnidia form regularly at temperatures between 10° C. and 30°C.; at 6° C. the formation of pycnidia ceases, while that of mycelium continues, though with checked vegetative growth.

*Effect of temperature.*

| Temperature | How obtained | Number of pycnidia | Increase in growth |
|---|---|---|---|
| 6 – 6 1/2° C | Constant temperature ice box with glass doors . | — | Slight |
| 10 – 12° » | Located at window in cold hallway . . . . . | 1 – 10 | Fair (1) |
| 20 – 22° » | Room temperature near window . . . . . | 1 – 10 | Strong |
| 23° » | Constant temperature incubator, outer door open, glass door closed . . . . . | — | Weak |
| 33° » | Constant temperature incubator, outer door open, glass door closed . . . . . | — | Weak |

(1) Pycnidia began to form after a week.

The absence of pycnidia in the 23° and 33° C. incubators, which is in seeming contradiction to the production of pycnidia in the summer time, was doubtless due to the fact that during the experiment, either the light was too much reduced or the air was depleted of oxygen.

Oxygen is indispensable both for the growth of mycelium and for reproduction. Open and sealed flasks of different sizes were used for the experiment, and from the results obtained it seems safe to conclude that an insufficient supply of oxygen causes the suppression both of growth and reproduction. In two cases only, pycnidium production took place in the sealed flasks, the fructification occurring in the larger flasks of the series.

Humidity merely delays, but does not suppress pycnidium formation, while it is at the same time favourable to the growth of mycelium.

*Effect of humidity: Test with corn broth under bell jars* (Time 30 days).

| Medium | Number of pycnidia | | | | | Growth | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Unaerated | Wet. | Mostly wet | Mostly dry | Dry | Unaerated | Wet | Mostly wet | Mostly dry | Dry |
| Corn Broth. | — | — | — | 1-10 | 25-50 | Feeble | Abundant | Abundant | Moderate | Feeble |

A minimum quantity of food is sufficient for growth, while a slightly larger amount is necessary for pycnidium formation, the amount contained in distilled water being enough. On the other hand, the organism will develop on an extremely rich and concentrated medium, while the formation of pycnidia ceases when the sugar solution is above M/100.

Very weak solutions of magnesium sulphate and potassium acid phosphate furnish the mineral elements necessary for the growth and reproduction of this fungus, and in combination with maltose and asparagin, constitute an excellent culture medium (synthetic solution) which retains the acid reaction necessary for pycnidium formation till the close of the growing period. An extensive bibliography follows.

573 – **A New Method of Selecting Tomatoes for Resistance to the Wilt Disease.** — Edgerton C. W. in *Science*, New Series, Vol. XLII, No. 1095, pp. 914-915. Lancaster, Pa., 1915. RESISTANT PLANTS

Perhaps the most serious disease of tomatoes in the southern United States is that caused by *Fusarium lycopersici*, commonly known as the tomato wilt. The fungus lives in the soil and attacks the plants through the roots, later growing up through the fibrovascular bundles into the stems. In this, as in similar diseases, the only practical method of control now known is in the use of varieties, or strains, that are resistant to the disease. By saving seed from healthy plants in a badly infected field for several seasons, strains can be obtained which show considerable resistance to the disease. This method has, however, several drawbacks: 1) Many of the plants in the field do not come in contact with the wilt fungus during the season and so do not have a chance to show whether they are resistant to the disease; 2) resistant plants in the field are readily pollinated by the susceptible plants; 3) the time necessary to obtain a wilt-resistant strain is too long.

To avoid all these drawbacks, the writer has tried to improve on the old method by selecting resistant plants from the seed bed.

In ordinary unsterilized soil, even if it is heavily inoculated with the tomato wilt fungus, not many of the plants will show the wilt to any extent before it is time to place them in the field. The presence of bacteria and other fungi seems to have an inhibitory effect on the wilt fungus. If, however, the soil is first sterilized by heat and then heavily inoculated with the wilt fungus just before planting, the disease will develop so well that all the plants will be attacked and the most susceptible will be killed

before they are large enough to be placed in the field. This guarantees the degree of resistance of the surviving plants which are placed in the field.

To show how this method works in practice, results of some experiments may be briefly given. Having by the old method of selection obtained a strain that showed considerable resistance to the wilt disease, this was compared by the seed bed method with three standard varieties of tomatoes. The seeds of each variety were planted side by side in reinoculated sterilized soil. Different cultures of the fungus from different localities were also used in order to see if they would affect the varieties differently. In the following table are given the percentage of living plants and of wilt-free plants of each variety 68 days after planting.

| Variety | Culture *A* | | Culture *B* | | Culture *C* | | Culture *D* | |
|---|---|---|---|---|---|---|---|---|
| | Living per cent | Healthy per cent | Living per cent | Healthy per cent | Living per cent | Healthy per cent | Living per cent | Healthy per cent |
| « Stone » | 35.3 | 11.8 | 75.0 | 55.0 | 44.7 | 25.5 | 71.4 | 57.1 |
| « Acme » | 14.3 | 0.0 | 42.9 | 28.6 | 31.3 | 21.9 | 65.8 | 31.6 |
| « Earliana » | 32.3 | 3.2 | 63.5 | 36.5 | 37.3 | 17.7 | 96.0 | 70.0 |
| Wilt-resistant | 62.5 | 31.3 | 81.8 | 56.8 | 68.2 | 34.1 | 95.1 | 78.0 |

This table shows the comparatively greater resistance of the wilt-resistant variety as compared to the others, and it also shows the large percentage of susceptible plants that could be eliminated before setting in the field.

MEANS OF PREVENTION AND CONTROL

574 – **Experiments on the Treatment of Cereal Seeds for the Control of "Bunt" and "Smut" and also for keeping off Birds** (1). — MALPEAUX O. in *Journal d'Agriculture pratique*. Year 80, New Series. Vol. 29, pp. 98-99. Paris, March 9, 1916.

Experiments have been carried out at the Agricultural School of Pas-de-Calais during 1914, for the purpose of discovering the best disinfectant for the seeds of wheat and oats, against "Bunt" (*Tilletia*) and "Smut" (*Ustilago*).

The percentage of germination of the seeds subjected to different treatments can be seen from the following table. Many commercial products are recommended for keeping off birds ("Corbeauline" etc.), but these are best prepared on the farm with TÉTARD'S formula. To 1.32 galls of heated mineral tar add, stirring continually, 0.66 galls of phenol and 0.22 galls of petroleum; 0.22 galls of this solution is sufficient for 2 $^3/_4$ bushels of grain over which powdered lime or rock phosphate should afterwards be scattered in order to dry it.

(1) See *B.* Oct. 1915, No. 1095. (*Ed.*).

The following table gives the results of experiments:

| | Percentage of seed germinated after different periods | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6 days | 7 days | 8 days | 9 days | 10 days | 11 days | 12 days |
| *Wheat.* | | | | | | | |
| Control | 88 | 90 | 91 | 96 | 96 | 98 | 99 |
| Copper sulphate, 0.5 % | 89 | 89 | 90 | 93 | 95 | 98 | 98 |
| » » 1 % | 55 | 73 | 74 | 87 | 90 | 93 | 94 |
| » » 1 % in contact for 16 hours | 65 | 69 | 76 | 84 | 92 | 93 | 93 |
| » » and lime | 85 | 90 | 93 | 95 | 96 | 98 | 98 |
| » » and starch | 78 | 91 | 94 | 94 | 97 | 98 | 98 |
| » » with starch and lime | 78 | 79 | 87 | 92 | 92 | 94 | 96 |
| Formaldehyde (1 in 400) | 28 | 30 | 51 | 84 | 96 | 97 | 98 |
| Lysol (8 ozs. per gall.) | 71 | 84 | 87 | 91 | 93 | 94 | 94 |
| Sulphuric acid (1.12 to 1.28 ozs. per gall.) | 92 | 92 | 95 | 96 | 98 | 98 | 98 |
| « Corbeauline » | — | — | 12 | 15 | 18 | 32 | 56 |
| *Oats.* | | | | | | | |
| Control | 91 | 92 | 92 | 96 | 98 | 98 | 98 |
| Copper sulphate, 0,5 % | 92 | 93 | 95 | 97 | 97 | 97 | 97 |
| » » 1 % | 91 | 93 | 94 | 96 | 96 | 96 | 96 |
| » » 1 % in contact for 16 hours | 80 | 84 | 87 | 93 | 94 | 94 | 95 |
| » » and lime | 86 | 91 | 94 | 94 | 95 | 95 | 95 |
| » » and starch | 91 | 93 | 94 | 94 | 95 | 95 | 95 |
| » » with starch and lime | 73 | 76 | 85 | 90 | 93 | 94 | 95 |
| Formaldehyde | 85 | 85 | 87 | 91 | 91 | 97 | 97 |
| Lysol | 86 | 88 | 92 | 92 | 93 | 94 | 95 |
| Sulphuric acid (as above) | 92 | 94 | 96 | 96 | 97 | 97 | 97 |

Treatment with solutions of copper salts diminish the germinating capacity of the seed, the action increasing with the concentration of the solution and with the length of its action. In practice, however, copper treatment is not very harmful to the future development of the seed for the highest loss in germinating power was 6 per cent for wheat and 7 per cent for oats. The treatment appears to reduce the energy of germination, for the seeds are all slower in germinating the stronger the copper solution is.

Solutions containing tar, used for keeping off birds, diminish the germinating power and retard the sprouting of the young plants. In this case, the remedy is probably worse than the evil, for risks are much diminished by the rapid germination of the seed.

Notwithstanding the disadvantages of the copper treatment the writer considers it preferable to other treatments, provided it be followed by the application of powdered lime which diminishes the harmful action of the copper salt.

575 - **Experiments on the Prevention of *Ustilago Avenae*.** — LIND J. in *Tidsskrift for Planteavl*, Vol. 22, p. 458-478. Copenhagen, 1915.

*Ustilago Avenae* (Pers) Jensen is very common in Denmark on *Avena sativa*, but it is by no means equally prevalent every year and its appearance would seem to be largely dependent on weather conditions. If oats are sown so early that the temperature of the ground is below 9° C, the resultant crop will be practically free from blight. Experiments have demonstrated that the blight can be killed entirely, without any injury to the germination of the seed, either 1) by immersing the seed twenty times in the course of five minutes in water at a temperature of 55-56° C, or 2) by sprinkling every 100 lbs. of oats with 10 lbs. of a solution of 0.2 per cent formaldehyde, covering it well, and letting it remain about twelve hours.

576 - **Control Experiments against *Ustilago bromivora* and *Ustilago perennans*.** — LIND, J. in *Tidsskrift for Planteavl*, Vol. 22, pp. 479-492. Copenhagen, 1915.

*Ustilago bromivora* is common in Denmark on *Bromus arvensis*, *B. commutatus* and *B. hordeaceus* ; abroad it is found on *B. arenarius*, *B. brachystachys*, *B. ciliatus*, *B. fasciculatus*, *B. lanceolatus*, *B. longiflorus* *B. macranthus*, *B. macrostachys*, *B. madritensis*, *B. marginatus*, *B. maximus*, *B. rubens*, *B. secalinus*, *B. sterilis*, *B. unioloides* and *B. villosus* in all parts of the world ; it has not yet been decided if it is a single species or if it can be divided into separate biological forms. Experiments have demonstrated that the fungus can be destroyed without affecting the growing properties of the seed in the five following ways : 1) By soaking the seed in water for three hours, letting it remain in the wet sacks for ten hours, and then dipping it twenty times in the course of five minutes in water at a temperature of 50°-51° C, 2) By dipping the dry seed twenty times in five minutes in water at a temperature of 54°-55° C, 3) Soaking in a solution of 0.2 per cent formaldehyde for six hours, 4) Soaking in a 0.1 per cent solution of formaldehyde for six hours, 5) Spraying each 100 lbs. of seed with 60 lbs. of a 0.1 per cent solution of formaldehyde whilst stirring vigorously, covering for twelve hours and then drying by hot air at a temperature of 80°.

*Ustilago perennans* is only found on *Avena elatior;* it is controlled by the means above specified.

577 - **Sulphur-lime Mixture as a Substitute for Bordeaux Mixture in Controlling certain Fungi Parasitic on Fruit Trees.** — SAVASTANO L. in *R. Stazione sperimentale di Agrumicoltura e Frutticoltura, Bollettino* No. 22, pp. 1-4. Acireale, February 1916.

According to experiments made in Italy and elsewhere, the sulphur-lime mixture may replace the copper-lime mixture in the following cases :

1) "*Brusone*" or "*Apple-leaf-spot*". — All Pomaceae are attacked by *Fusicladium pirinum* Fuck. and *F. dendriticum* Fuck. These parasites are controlled by means of two successive sprayings with a sulphur-lime mixture having a density of 1.25. The first, or winter spraying of

10 % strength is repeated if the orchard has been badly attacked by the parasite ; and the second spraying of 5 % strength is done after the petals fall. The parasite is controlled by the first spraying while it hibernates on the trunk or branches, while the second treatment controls its attacks on the leaves and fruit. This second treatment may be followed by a third or even a fourth when the weather is damp. The summer treatments must be done carefully, for they easily cause scorching of the leaves.

2) "*Bozzacchioni*" or "*Exoascus swellings on Drupaceae*". — Amongst Drupaceæ, the peach tree is the most attacked by *Exoascus deformans* Fuck ; next follows the plum tree attacked by *E. pruni* Fuck. The life history of these parasites suggests two separate sprayings ; the first with an 8 % solution when the buds begin to swell, and the second with a 5 % solution after the shedding of the petals. In rainy weather, a third spraying of 5 % strength may prove useful. It may be noted that with peach trees a slight scorching of the leaves cannot be avoided.

3) "*Occhio di pavone dell'olivo*" — *Cycloconium oleaginum.* — For this parasite the sulphur-lime mixture may be used. If the parasite remains on the tree during the winter, a spraying in this season may be done with a 10 % solution. After the shedding of the flowers, two or three sprayings at 5-6 %, according to the conditions of the season, may be applied when the parasite first appears.

Besides being used against cryptogamous diseases, the sulphur-lime mixture may be used against Acari, Aphides and Scale-insects (*Chrysomphalus dictyospermi* Mask.). In these cases, this mixture may be applied instead of the copper-lime mixture which is three times more costly.

578 - **A Fungus of Uncertain Systematic Position occurring on Wheat and Rye in the Salt Lake Valley.** — O' Gara P. J. in *Science*, New Series, Vol. XLIII, No. 1099, pp. 111-112. Lancaster, Pa., January 21, 1916. DISEASES OF VARIOUS CROPS

For some time the writer has been studying a very interesting organism which has been found occurring on wheat and rye in the Salt Lake Valley. The fungus seems to attack the heads of both wheat and rye some time before they emerge from the sheaths. Very often the heads are so severely attacked that they do not emerge, but remain permanently within the sheath. The fungus is usually found on the rachis, the glumes, the essential organs and the inner parts of the sheaths. The effect upon the inflorescence seems to be such as to prevent the normal development of the essential organs.

The writer was able to isolate the specific agent, a fungus having a white or hyaline mycelium. Perithecia-like bodies are borne on either short or long stalks on the mycelium or they may be borne terminally.

In some respects this fungus bears a stricking resemblance to *Endomyces mali* Lewis. However, no sporidia are produced and the perithecia-like bodies do not contain germinating ascospores.

579 - **A *Phoma* Disease of Western Wheat-grass in Salt Lake Valley** (1).— O' Gara P. J. in *Science*, New Series, Vol. XLIII, No. 1099, pp. 110-111. Lancaster, Pa., January 21, 1916.

During the summer of 1915. specimens of Western wheat-grass, *Agropyron smithii* Rydb., a very important forage plant in Salt Lake Valley, were collected in that region. On the plants was found a *Phoma* which does not seem to have been previously recorded as occurring on A. smithii. A considerable number of species of *Phoma* have been found on Gramineae but many of them are imperfectly described, so that it is difficult to tell whether the species of *Phoma* occurring on Western wheat grass is or is not new.

In some respects it resembles *Phoma lophiostomoides* Sacc., although the spores are smaller, being as a rule less than 15 μ in length. Owing to the size of the spores and other prominent characters on which the writer will publish later a more extended note, it is possible that the species is new.

580 - ***Monilochaetes infuscans* (Sweet Potato Scurf) Injurious to Sweet Potato.** — Harter L. L. in *Journal of Agricultural Research*, Vol. V, No. 17, pp. 787-791, Pl. LVII-LVIII. Washington, D. C., January 24, 1916.

The sweet potato scurf disease is characterised by a brown discolouration of the surface of the underground parts of the sweet potato. The discoloured areas may occur as spots of varying size with no definitive outline, or as a uniform rusting of the entire surface.

Although the infection is very superficial and produces no rupture of the epidermis, scurfy potatoes do not command as high a price in the markets as do clean ones. The fungus, under favourable conditions such as a relatively high humidity and temperature, continues to develop under storage, and besides rendering the potatoes unfit for sale, makes them at the same time less resistant to the attacks of other parasites.

Scurf is more prevalent in heavy, black soils and in soils that have been heavily manured or contain a large amount of organic matter, than in light sandy soils. The writer found the scurf very prevalent on sweet potatoes in New Jersey, Delaware, Maryland, Virginia, North Carolina, Ohio, Illinois, Iowa and Kansas, and to a slight extent in other States. The following varieties are susceptible to scurf in varying degrees: Eclipse Sugar Yam, General Grant Vineless, Florida, Nancy Hall, Yellow Yam, Miles Yam, Red Brazilian, Dahomey, Yellow Strasburg, Pierson, Key West Yam, Vineless Yam, Southern Queen, Big Stem Jersey, Yellow Jersey, and Early Carolina.

The scurf disease of the sweet potato was first recognised in 1890 by Halsted, who named the fungus "*Monilochaetes infuscans*", a new genus and species. He failed, however, to describe either the genus or species. The writer has isolated the organism and shown by inoculation experiments that it is the true cause of the disease. After a detailed description, he

(1) See *B.* February 1916, No. 242. (*Ed.*).

points out that although the organism on the host consisted merely of sporophores and conidia, in culture well-defined branched mycelia and spores developed.

581 – **Further Studies on Peanut Leafspot (*Cercospora personata*), Injurious to the Leaves of *Arachis hypogaea*.** — WOLF FREDERICH A. in *Journal of Agricultural Research*, Vol. V, No. 19, pp. 891-902. Washington, D. C., February 7, 1916.

Researches have been conducted in Alabama in order to determine : 1) the efficacy of rotation and seed treatment in the control of leaf-spot, *Cercospora personata* (B. and C.) Ellis, which causes spots on the leaves of *Arachis hypogea* ; 2) the correlation between the destructiveness of the disease and the presence of certain climatic conditions ; 3) the agencies concerned in the distribution of leafspot.

The following results were obtained : —

1) Rotation by itself is not effective under field conditions in eliminating leafspot, as shown by a field in which peanuts had not been grown for 11 years and in which 95 per cent of the plants were diseased by August 31, with an estimated loss in yield of 19.5 per cent ; the germs of the fungus continue to develop and spread in the soil even in the absence of the host plant, so that seed disinfection with copper sulphate or formaldehyde before planting does not prevent leaf spot, Neither does shelling peanuts before planting to eliminate the danger of infection from conidia, prevent the disease ; 2) An approximation of the total leafspot area involved by *Cercospora personata* showed that the photosynthetic area had been decreased 35.07 per cent. Estimation of decrease in yield of peas of from 5 to 20 per cent as the result of leafspot are therefore regarded as reasonable ; 3) No correlation between the presence of certain conditions of temperature and moisture. and the prevalence of leafspot exists; 4) the wind largely contributes to the dispersion of the fungus ; as the results of 210 glycerin exposure-plate tests made in different parts of Alabama, it is concluded that *Cercospora personata* is wind-borne. Seventy-eight of these 210 exposure plates gave positive results. At no time from August 9 to August 26 was there a period of maximum spore dispersal as revealed by the exposure plates ; 5) Many insects are disseminators of the leaf-spot fungus, either by carrying conidia on the surface of their bodies or by voiding conidia in their fæces, the vitality of the fungus being in no way diminished ; of 75 insects belonging to the orders Orthoptera, Lepidoptera, Coleoptera, and Hemiptera, collected in 5 different localities, 54 gave positive results.

582 – **Brown Blight of Tea (*Colletrotrichium Camelliae*) in India.** — MACRAE W. and ANSTEAD RUDOLPH D. in *The Planter's Chronicle*, Vol. XI, No. 1, pp. 2-4. Bangalore, January 1, 1916.

*Colletrotrichium Camelliæ* has recently become prevalent on Tea plantations in the neighbourhood of the Nilgiri-Wynaand and Wynaand districts and it has caused more damage than usual, causing defoliation and weakening the whole plant. The fungus has also been noted in two instances on nurseries, where it does a considerable amount of damage.

Brown blight has been reported from Assam, Darjeeling, and Ceylon,

and also from Tea growing districts in other parts of the world. In all the districts of southern India visited by the writers, this disease is present. The following recommendations for the control of the disease are suggested :

1) In nurseries : As soon as the disease appears, all attacked leaves should be picked off and burned and the plants then sprayed with Bordeaux Mixture. The plants should then be watched, and on any signs of the disease reappearing, a second spraying should be given. All dead and dying plants as well as fallen leaves on the ground should be removed and burned. Slaked lime should be sprinkled on the ground surface of the beds and lightly worked in. The nurseries should be kept as open to light and air and as dry as is consistent with the wellbeing of the plants. Watering should be very carefully done and only when absolutely necessary, in order to avoid too moist conditions and a damp atmosphere favourable to the growth of the fungus. The surroundings of the nursery should be freed from weeds and jungle and kept as open to the sunlight as possible.

2) In old Tea : When the old Tea is not badly attacked, it is best not to do anything until pruning time. Where the Tea is attacked all prunings should be burned and all fallen and dead leaves should, as far as possible, be collected and burned. Slaked lime should be broadcasted at the rate of 5 cwt. per acre and forked in so as to bury any refuse that may be left and to clean up the fields. Manures which tend to produce a rapid growth of sappy wood and abundance of leaves, such as nitrates, nitrolim, etc., should be avoided on areas liable to the attack of the fungus. Nitrogen, if needed, should be supplied in the form of organic manures such as Cattle manure, Poonacs, Fish, etc., or better still green dressings such as Dadap. Manures which tend to produce hard wood should be used, such as Phosphates and Potash, and mixtures of Basic Slag, or Basic Superphosphate, or Ephos phosphates, with Sulphate of Potash. Wood Ashes might replace the potash for the present.

583 – ***Oidium quercus*** **on Chestnut Trees in Italy** (1). — TROTTER A. in *L'Alpe*, Series II, Year III, No. 2, pp. 49-53. Florence, February 1916.

In opposition to BUREAU'S assertion that the chestnut tree is not susceptible to the attack of " Oidium quercus ", the writer was able to verify with certainty on September 17, 1915, a case of intense infection on the new sprouts growing from the stocks of old chestnut trees felled in the neighbourhood of Vittorio Veneto on the slopes of Mount Pizzoc.

In 1910, FARNETI had already alluded to the presence of " Oidium " on chestnut trees in the vicinity of Savona.

Besides the oak, this fungus therefore attacks the chestnut, and also the beech tree in Italy, as FARNETI reports from the Bolognese Appennines in 1910. The field of observation is thus, according to the writer, much broadened as regards the afinity of " Oidium quercus " with its ascus-

(1) Concerning this disease see *B.* Nov. 1910, p. 181 ; *B.* Dec. 1910, pp. 357, 404 and 410 ; *B.* March 1911, No. 998 ; *B.* April 1911, No. 1298 ; *B.* June 1911, No. 1892 ; *B.* March 1912, No. 577 ; *B.* May 1912, No. 852 ; *B.* Dec. 1913, No. 1395 ; *B.* Jan. 1914, No. 75 ; *B.* Dec 1914. No. 1184. (*Ed.*).

bearing form whch may therefore be searched for, not only on the exotic representatives of the genus *Quercus*, but also on those of the genera *Castanea* (incl. *Pasania*) and *Fagus* (incl. *Nothofagus*), if its identity with *Microsphaera quercina* Schw. or *M. alphitoides* Griff. and Maubl. be not accepted. Although the writer closely examined the locality, he was unable to find other centres of infection, and came to the conclusion that the stocks which produced the infected sprouts must have been in very special conditions.

In fact, the virulence of the sudden attack was explained by the circumstance that the trees in question were felled for urgent reasons, quite out of season, and between the 7th and 16th of July. There is no doubt that the new shoots, weaker because of the season and the altitude, could not have sprouted sooner than the middle of August, developing with difficulty and consequently being in a highly receptive condition. On the other hand, the "Oidium" is at that time in its most active phase of spore-bearing and consequent infectiousness. Therefore, while the specific receptivity shown by the chestnut is to be feared — all the more that in many regions, especially of the Appennine, the felling of the chestnut woods is one of the most extensive and remunerative forms of culture the circumstance above noted allows of the hope that when the trees are not felled out of season they may remain practically immune from infection.

584 - ***Polyporus Schweinitzii* injurious to Conifers in Great Britain.** — MURRAY J. M. in *Transactions of the Royal Scottish Arboricultural Society*, Vol. XXX, Part I, pp. 56-57, Pl. VII. Edinburgh, January 1916.

*Polyporus Schweinitzii* Fr., has hitherto been regarded as a rare species in Britain, but it would now seem to be becoming much more common, and may yet have to be looked upon as a great danger to coniferous forests. It attacks Douglas fir and Sitka spruce in Perthshire, and Scots pine in Midlothian. It has also been recorded on larch in England. The rot produced is rather characteristic. At first the wood becomes dull-yellow, later it changes to dark brown. Here and there, small white patches or pockets of mycelium may be seen. The whole mass becomes brittle, very light, and is broken up by many fissures. The decaying wood has a turpentine-like odour.

The following remedial and preventive measures are suggested : 1) Cut of affected roots well above the place where the last sign of rot appears, and tar the wound ; 2) Collect and burn sporophores while young ; 3) Cut out badly attacked trees and plant hardwoods in their place.

585 - **A serious Disease in Forest Nurseries caused by *Peridermium filamentosum* (1).** — WEIR JAMES R. and HUBERT E. ERNEST in *Journal of Agricultural Research*, Vol. V, No. 17, pp. 781-785. Washington, D. C. January 24, 1916.

In June 1914, several seedlings of *Pinus ponderosa* Laws., with the stems severely infected with a disease caused by a species of *Peridermium*, were received from the Savenac nursery of the United States Forest Service at Hangan, Mont.

(1) See, *B.* February 1916, No. 251. (*Ed.*).

On July 2, 1914, *Castilleja miniata* Dougl., growing in abundance on the nursery site, was found bearing the fungus *Cronartium coleosporioides* (D. and H.) Arthur. No other species of Cronartium was found, and it seemed certain that the fungus on the pine seedlings could be no other than *Peridermium filamentosum* Peck., the aecidial stage of *Cronartium coleosporioides*. On May 1, 1915, all of the two-year-old yellow pine seedling beds were found to be infected with the fungus. Most of the infections were found along the north and east borders of the seedling beds. A large patch of *Castilleja miniata* was growing on the edge of a lodge-pole pine (*Pinus murrayana* "Oreg. Com.") stand near the creek bank directly northeast of the infected seedling beds. The winds prevalent in the region blow both northeast and southwest, which is an important factor in spore distribution between the two hosts; the aecidiospores from the infected yellow pine being thus distributed to the *Castilleja* plants and the sporidia borne on the *castilleja* leaves are transmitted to the young trees in the beds. Towards the middle of May, this fungus infection was found to be of serious importance on the yellow pine. From fresh specimens of the blister rust, two plants of *Castilleja miniata* were inoculated on May 3, 1915. On May 23, uredospores developed on the underside of the leaves; later the teleutospores developed, sporidia being produced on May 29. Duplicate experiments were conducted at the field camp at Priest River, Idaho, with positive results. The characteristic filamentous structure of the aecidia on the pine seedlings and the transfer of the fungus to castilleja plants prove the fungus to be *Peridermium filamentosum* Peck. In May 1915, the native lodgepole pine surrounding the nursery was found to be infected by Peridermium on the trunk, as well on the branches and needles.

The trunk form (known locally as the "hip canker") and the branch-gall form have been referred to *Peridermium cerebrum* Peck by Arthur and Kern. Experiments carried out, prove that the "hip canker" and the gall-forming Peridermium of the lodgepole pine are both *Peridermium filamentosum*.

On May 17, 1915, aecidiospores from the "hip canker" of *Pinus contorta*, were sown on two plants of *Castilleja miniata*. On June 3 uredospores were present on the leaves. The teleutospores appeared on June 14. The Cronartium was identical with that previously produced by the inoculations on *Castilleja miniata* with aecidiospores from the Peridermium on the 2 year-old seedlings of *Pinus ponderosa*. This demonstrates the identity of the "hip canker" Peridermium with *Peridermium filamentosum*.

The same may be said for the "branch-gall" of *P. contorta*; aecidiospores from the gall-forming Peridermium on branches of lodgepole pine sown by the writers on plants of *Castilleja miniata*, gave origin in all cases to *Cronartium coleosporioides*. *Peridermium stalactiforme* A. and K. which causes the blister rust of *P. contorta* is also identical with *P. filamentosum*.

The absence of oaks (*Quercus* spp.) the alternate hosts of *P. harknessii* and *P. cerebrum* confirms all that has hitherto been said.

The yellow pine seedlings in the nursery were free from traumatic

injuries. It is safe to draw the conclusion, therefore, that the spore tubes which produce the infections in the seedlings penetrate the host in the absence of all surface openings due to mechanical injuries. The period of development between the time of penetration of the host and the appearance of the aecidial eruptions on the stems is about 10 to 11 months. The infecting spores could have been either sporidia from the species of *Cronartium* on *Castilleja miniata* or possibly aecidiospores from the surrounding lodgepole pines infected with *Peridermium filamentosum*. In June 1915 a survey was made in the surrounding area of Savenac nursery for a distance of half a mile. Fifty per cent of the lodgepole pine stand in close proximity to the beds was badly infected with *P. filamentosum*. *Castilleja miniata* was found growing in abundance under the trees.

Experiments are being tried in order to control the disease: the following measures may be advised:

1) spraying the seedlings in the nursery beds with the usual fungicides during the infection period;

2) eradicating and destroying all infected material;

3) felling and burning the alternate host trees in the neighbourhood of the nurseries.

## PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

586 – ***Orobanche ramosa* and *O. cumana* Parasites of Tobacco in Roumania** (1). — GRINTESCO I. in *Directiunea Generala a Regici Monopoluriler Statului Buletin*, Year II, Part 3-4. pp. 10-31, Figs. 6, Pl. 2; Year III, Part 1-2, pp. 1-28, Figs 7-13, and Part 3-4, pp. 20-23. Bukarest, 1915-1916.

Amongst the numerous foes of tobacco existing in Roumania, the *Orobanchaceae* hold the first place both for the vast amount of harm they cause and for the rapidity with which they spread

The species known in that region are two: *Phelypaea ramosa* C.A. Mey (= *Orobanche ramosa* L.) and *Orobanche cumana* Wallr., the last being now for the first time reported as a parasite of tobacco in Roumania. *Phelypaea ramosa*, commonly known by the names of "Lupoae" "Ciuma Tutunului" and "Cicee", appears about the end of June, and exceptionally, when the season happens to be very rainy and damp, in the second half of July or the first half of August. It may be said to spread over the whole of Roumania having been reported from: Zerbinit, Odobesti, Petricani, (Neamtu), communes of Maea and Braila, Bivolari (Iasi) Caldarusani (Greci), Macin, and is very frequent in the northern districts of Dobrugia.

There are, however, two large separate centres of infection, one in north Dobrugia, the other in Moldavia in the district of Priponesti-Tutova. Besides tobacco, this *Phelypaea* attacks numerous other cultivated and

(1) See *B.* June 1911, No. 1938, and *B.* June 1914, No. 577. (*Ed.*).

wild plants : hemp, *Cucurbita Pepo*, potato, etc. It is reported for the first time in Roumania as a parasite of *Filago avvensis, Veronica officinalis* and *Cuburbita Pepo* at Suluk (Macin) and near the monastery of Cocos (Tulcea).

*Orobanche cumana* Wallr., a plant but little known in Roumania, has spread from the south of Russia to Dobrugia, where the writer was able to collect several specimens attacking tobacco in the neighbourhood of Cocos.

The writer gives a long discription of both the species under examination, of their varieties and sub-varieties, origin and geographical distribution, and the means of control used against these parasites.

587 – **Turnip weed (*Rapistrum rugosum*, All.) in South Australia.** — ANDREW H. W. in *The Journal of the Department of Agriculture of South Australia*, Vol. XIX, No. 5, pp. 472-475, 2 Figs. Adelaide, 1915.

*Rapistrum rugosum* was very prevalent in 1915 in the wheat fields of the Northern districts and elsewhere in South Australia.

As a means of control against this weed, it is advisable to allow it to be grazed by sheep who eat these cruciferous weeds and destroy the plants. Also, careful examination of agricultural seeds coming from districts infested by *Rapistrum* should be carried out.

588 – ***Carrichtera annua*, a New Weed in Australia.** — QUINN GEORGE and ANDREW H. W. in *Journal of the Department of Agriculture of South Australia*, Vol. XIX, No. 4, pp. 380-383, Figs. 2. Adelaide, 1915.

In August 1915 a new plant belonging to the cabbage or mustard family (*Cruciferae*) and submitted to the Agricultural Department, was identified as *Carrichtera annua* (L.) Prantl, which has not previously been recorded as growing in Australia. The plant was not noticeable more than a couple of years ago, but now extends over 100 to 200 acres in the neighbourhood of Port Pirie (South Australia). This plant, if not exterminated in the near future, is likely to become very widespread and cause much trouble. Steps must therefore be taken to eradicate or restrict this weed by the local authorities, or private individuals, on whose land it may be found growing.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

GENERALITIES

589 – **Some Injurious Indian Weevils (*Curculionidae*).** — MARSHALL GUY A. K. in *Bulletin of Entomological Research*, Vol. VI, Part 4, pp. 365-376, Figs. 1-5. London, February 1916.

Six new species of *Curculionidae* injurious to cultivated plants, are reported from India :

1) *Emperorrhinus defoliator*, in the following districts : (Punjab) Chawai, Kulu, Kangra ; (Sikkim) Kurseong, Darjiling ; (Assam) Khasi Hills. It destroys the foliage of the alder (*Alnus nitida*), peach, apricot, pear, apple and cherry. 2) *Coniatus indicus* at Pusa (Bengal) injurious to *Tamarix indica*. 3) *Ceuthorrhynchus portulacae* the larvae of which damage the

leaves of purslane (*Portulaca oleracea*) at Pusa. 4) *Baris portulacae* damages the same plant by boring the stems, also at Pusa. 5) *Athesapeuta oryzae* attacks rice at Coimbatore, Pithapuram, Godaveri (Madras). 6) *Acythopeus citrulli*, a pest of water melons, at Coimbatore (Madras), Hadagalli and Hagari (Bellary District) and Koilpatti (Tinnevelli District).

590 – **Insects Injurious to Cultivated Plants in the Nyassaland Protectorate** (1). — Mason C. in *Nyassaland Protectorate, Annual Report of the Department of Agriculture for the year ending 31st March*, 1915, pp. 36-49. Zomba, Nyassaland, 1915.

Cotton. — Among Coleoptera the following may be mentioned: 1) four or more species of the family of *Scarabaeidae*, especially *Plaesiorrhina trivittata* Sch., which eats the pods; 2) a Tenebrionid not yet identified, discovered in large numbers at Nyachiperi and Namiwawa, where it injures the leaves; 3) *Ootheca mutabilis* Sahlb. (fam. *Chrysomelidae*) which also attacks the foliage; 4) *Apion armipes* Wagn. (*Curculionidae*) which has spread with extraordinary rapidity in the plantations, destroying the bark of the plants just above the collar; after an *Apion* attack an invasion of white ants generally follows causing the final destruction of the plants. Uprooting and destroying all infected plants is the best means of control.

Among the Lepidoptera are: 1) *Diparopsis castanea* Hmpsn (" red boll-worm "); 2) *Chloridea obsoleta* F. (" American boll-worm ") which, besides cotton, attacks *Cicer arietinum*, *Helianthus annuus*, hemp, corn, ground-nuts, tobacco, tomato, *Morus* spp., *Brassica* spp. and ornamental plants belonging to the genera Solanum, Geranium and Hibiscus; 3) *Prodenia litura* F., abundant during February and March; 4) *Earias insulana* Boisd., which also destroys the leaves and shoots of *Hibiscus* and is often found in the pupal stage in the trunks of *Eriodendron*, which may thus be numbered among the host plants of this moth; a Braconid, *Rhogas* (?) is reported to be a parasite of *Earias;* 5) *Sylepta derogata* F. (" cotton leaf-roller "), abounding in the regions S. E. of Lake Nyassa; among its natural enemies are two Chalcids, some Braconids, and an Eumenid; 6) *Tortrix* sp. " cotton shoot webber "; 7) *Acrocercops bifasciata* Whrm. (?) " cotton leaf-miner "; 8) *Hypolymnas misippus* Linn.; 9) *Catopsilia* sp.; 10) *Acontia graellsii* Feisth.; 11) *Ophiusa* sp., which attacks and sometimes almost completely destroys the foliage; 12) *Cosmophila erosa* Hübn.; 13) other Lepidoptera not yet identified belonging to the families *Noctuidae*, *Lymantriidae*, and *Geometridae*.

Among the Hemiptera are mentioned: 1) *Dysdercus nigrofasciatus* Stal. and *D. intermedius* Dist., common especially on the river banks of the plateau; they cause the pods to fall off, premature flowering and various other anomalies in growth and development; 2) *Oxycaraenus hyalinipennis* (?), common in the districts of Port Herald and Mpimbe; 3) *Anoplocnemis curvipes* F., which has as host plants, besides cotton, also *Helianthus*, *Dahlia*, *Hibiscus*, Mango, *Ficus* sp., *Brachystegia* sp. and many

(1) See *B.* July 1914, No. 690. (*Ed.*).

annual or perennial Leguminosae ; 4) a representative of the *Membracidae* ; 5) a species of *Jassidae* ; 6) *Aphis gossypii* Glover etc.

Tobacco. — This plant does not in general suffer much from insect attacks ; the following may, however be recorded : 1) *Prodenia litura* F, which also attacks cotton, as has been already mentioned ; as control, the arsenate of lead treatment is advised and also the collection and destruction of larvae and eggs ; amongst the natural enemies, besides the insect parasites already known, is also a bird, *Corvus scapulatus* Dand. which destroys a considerable number both of larvae and adults ; the writer was able to examine the stomach contents of two of these birds and found in one of them 7 larvae of *Prodenia litura*, 23 specimens of *Termes bellicosus* Linn. and 1 species of *Carabidae* ; in the other, 2 specimens of *Gastromargus* (?), 13 *Termes bellicosus*, 11 *Prodenia litura ;* 2) *Phthorimaea heliopa* Low. (" tobacco stem caterpillar ") ; for which it is advisable to destroy all the infected seedlings in the nurseries ; 3) *Lasioderma serricorne* F. ; 4) *Agrotis* sp. (" cutworms ") ; 5) *Hippotion celerio* Linn.

Maize. — Is attacked by : 1) larvae of *Busseola fusca* Hmp (?) that penetrate into the thickness of the cob, boring long galleries through it ; the plants thus attacked wither and break off very easily at the least touch or breath of wind ; these larvae appear very late, when the maize is almost ripe, so that the damage is not extensive ; the late varieties are thus more subject to injury than the early varieties ; as control, it is well to remove all vegetable refuse from the infested fields and to introduce the practice as yet not applied in these regions of topping the plants 2) *Chloridea obsoleta* F., *Cirphis loreyi* Dup. (?) *Eublemma* sp. injurious to the flowers, cause lesions that open the way for other insect attacks or for cryptogamic infections, etc. ; 3) *Elaunon erythrocephalus* Oliv. (?) ; 4) *Arctiidae, Lymantriidae* and larvae of *Catopsilia* sp. damage the leaves.

Other Cereals. — Wheat, barley, oats and rye have been injured by white ants, and in the district of Fort Johnston, a swarming of locusts has occurred in the wheat fields.

Mustard. — At Namiwawa this plant has been attacked first by the larvae of *Athalia* sp., then by *Aphis* sp. and finally by a bacterial disease that completely destroyed the crop.

Helianthus. — Is attacked by *Anoplocnemis curvipes* F. but with slight damage. It may be useful to plant many specimens of *Helianthus* in the cotton fields, as *Anoplocnemis* may be attracted to these plants for which it shows a marked preference, and abandon the cotton. *Cicer arietinum* a favourite plant of *Chloridea obsoleta*, another enemy of cotton, might be used similarly.

Mango, peach, pineapple. — Have been attacked by *Drosophillidae* that feed on the unripe fruit ; some *Scarabaeidae* eat the ripening fruit of peach, especially *Plaesioorrhina trivittata* Sch.

Mulberry. — Two species of scale insects attack this crop : *Diaspis pentagona* Targ. which has for natural foes in Nyassaland a fungus, perhaps *Macrocera*, and a local species successfully controlled by two Lepidoptera, a Pyralid and an *Eublemma*.

*Khaya Senegalensis.* —Special attention should be given to the larvae of *Heteronygmia lencogyna* Hmpsn. that injure the foliage ; this insect is spread throughout all Nyassaland from the district of Zomba to that of Mlanje and must be also fairly common at Mbawa ; the larvae of *Mussidia albipartalis* Hmp. perforate the bark and penetrate into the zone of the cambium, causing large and varied excrescences on the trunk and main branches.

591 – **Report on some Coccidae from Zanzibar.** — Green Ernest E. in *Bulletin of Entomological Research*, Vol. VI, Part 4, pp. 375-376, London, February 1916.

A list comprising the following species collected by Dr. W. M. Aders : *Icerya seychellarum* Westw., on *Citrus limonii ; Asterolecanium bambusae* Bdv., on stems of large bamboo ; *Pseudococcus citri* Risso, on immature cotton bolls, under the sepals ; *Ps. crotonis* Green, food-plant not mentioned ; *Ps. perniciosus* Newst., on Shu-shu, a Cucurbitaceous plant ; *Ps. virgatus* Ckll., on cotton (*Gossypium*), and on *Clitoria ; Lecanium hesperidum* L., on indigenous fern ; *L. viride* Green, on coffee leaves and young terminal shoots ; *Pulvinaria antigoni* Green, on stem of chilies and on leaf of *Luffa acutangula ; Ceroplastes floridensis* Comst., on *Persea gratissima ; Ceronema? africana* Macfie., on Leguminous climber ; *Aspidiotus cyanophylli* Sign., and *A. destructor* Degn., on husk of coconut ; *A. dictyospermi* Morgan, on stem of seedling mango ; *A. ficus* Ashm., on rose stalks ; *A. lataniae* Sign., on husk of coconut ; *A. trilobitiformis* Green, on pomelo (*Citrus decumana*) leaves, indigenous fern, *Ficus elastica* and young Citrus trees ; *Diaspis pentagona* Targ. on *Hibiscus sabdariffa* and papaw fruits (*Carica Papaya*) ; *Hemichionaspis minor* Mask., on husk of coconut ; *Hemichionaspis* sp., near *rhododendri* Green. on sisal hemp (*Agave sisalana*) ; *Ischnaspis longirostris* Sign. on coffee ; *Lepidosaphes citricola*, Packard, on orange rind and young orange trees.

592 – **Notes on Samoan Coccidae.** — Doane R. W. and Terris G. T. in *Bulletin of Entomological Research*, Vol. VI, Part 4, pp. 399-402, 3 Figs. London, February 1916.

A list of coccidae collected in Samoa including the three new species : *Chionaspis samoana* on palm trees ; *Aspidiotus pangoensis*, on coconut husks ; and *Lepidosaphes moorsi* on truks of orange trees. The other species enumerated are :

*Asterolecanium bambusae* Bdv., very abundant on bamboo ; *Coccus frontalis* (Green), *Coccus viridis* (Green), *Lecanium psidii* Green, and *Pulvinaria psidii*, Marsk, on unidentified plants ; *Ceroplastes rubens* Mask., extremely abundant on mango ; *Saissetia nigra* (Nietn), host not identified ; *S. oleae* (Bern), common on oranges and several other plants ; *S. hemisphaerica* (Targ.), on several different hosts ; *Eucalymnotus tesselatus* Sign., on unidentified host ; *Chionaspis citri*, Comst., very abundant on orange, *Hemichionaspis aspidistrae* (Sign). on palm, banana and orange etc. ; *Aspidiotus cydoniae* Comst., on orange and an unidentified plant ; *Chrysomphalus rossi* (Mask.), on coconut husks ; *Odonaspis secreta* Ckll., common on bamboo ; *Lepidosaphes beckii* (Newm), very common on orange ; *L. gloverii* (Pack), on orange ; apparently much less common than *L. beckii ; Parlatoria cinerea* Doane and Hadden, common on orange.

593 – **On the Existence of Two Annual Generations of the "Elm-galerucella" (*Galeruca luteola* F. Müller) and their Alternation** (1). — LECAILLON A. in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. 162, No. 13, pp. 481-484. Paris, March 27, 1916.

In the region of Toulouse the " elm galerucella " lays its eggs on the under-surface of the leaves of that tree, from the first days of May to the beginning of September, that is, a period of four months. There are two successive generations each of which reproduces itself in about two months. The second generation produces a third, the hibernating one ; this generation constitutes the first spring generation. But as each female lays eggs at repeated intervals during a period that may extend to one and a half months, the adults of the second generation appear before those of the first generation have finished laying their eggs, and those of the third generation before all those of the second generation have finished reproducing. It happens, therefore, that individuals of " galerucella " belonging to two different generations are found at one time on the elms. It may be possible that adults of the second generation which have not yet finished laying their eggs should hibernate and continue to reproduce in the following spring (thus forming the *first generation* of the successive year) and that certain adults of the third generation should commence laying their eggs before hibernating.

MEANS OF PREVENTION AND CONTROL

594 – **Control of Injurious Aphids by Ladybirds in Tidewater, Virginia.** — FINK DAVID E. in *Virginia Truck Experiment Station, Bulletin* 15, pp. 337-350, Figs. 72-77, Norfolk, Virginia, 1915.

The control of aphids, or plant lice, by distributing ladybirds on a large scale originated in the State of California.

Shipments of ladybirds from California to Norfolk were begun in 1910. The plan was to establish colonies of ladybirds, whence they could in time spread throughout the entire truck section of Tidewater, Virginia, During 1910 to 1911 several colonies of two species of ladybirds, the spotted ladybird (*Megilla maculata*) and the convergent ladybird (*Hippodamia convergens*), were liberated, but the largest number of the convergent lady birds was established by the writer during the years 1913 and 1914. In all, 21 colonies were distributed, making a total of nearly a million ladybirds.

The colonies were placed within five miles of each other and were usually liberated during the early spring ; a colony contains approximately from 30,000 to 33,000 ladybirds.

The life of a ladybird from egg to egg is from four to six weeks. The life of a larva is about 20 days ; that of the adult ladybird varies from 20 to 50 days.

The number of aphids eaten by a larva during its lifetime is about 250 ; by an adult, from 100 to 1,000.

There are five generations of the ladybirds in Tidewater, Virginia.

(1) See *B.* Oct. 1914, N. 968. (*Ed.*).

During July and August the ladybirds for the most part do not breed, and are partly inactive.

*H. convergens* prefers smaller, soft-bodied aphids, and is very fond of the cabbage aphis (*Aphis brassicae* L.), melon aphis (*A. gossypii* L.), spinach aphis (*Myzus persicae* Sulz.) and bean aphis (*A. rumicis* L.); when food is scarce it will feed also on other species, and does not disdain even *Macrosiphum rudbeckiae* Fitch, a large red species which is common on golden glow (*Rudbeckia lacinata*). In extreme cases it will feed on other sucking insects, like the egg plant lace-bug, and also on the eggs of the potato beetle, or even the pollen of certain plants, particularly maize. *M. maculata* is less discriminating and feeds on any species of aphid within reach. The first to leave for hibernating quarters is the spotted ladybird, usually about the middle of November. The convergent ladybird during mild writers may continue to feed as late as Christmas.

In California, the ladybirds hibernate during the winter in the Sierra Mountains. In Tidewater, Virginia, the convergent ladybird hibernates in proximity to the feeding areas in weeds, débris, or in the ground. The spotted ladybird hibernates on trunks and stumps of oak trees.

There are very few natural enemies of the ladybirds though some birds feed on them. A large number are probably destroyed by persons unfamiliar with their utility and who misake them for injurious species.

The ladybirds are considered valuable as checks to sporadic outbreaks of aphids. Where the ladybirds were colonized, no further serious trouble from aphids has been reported.

595 – **Natural Enemies of Sugarcane Borers in Java.** — VAN DER GOOT P. in *Mededeelingen van het Proefstation voor De-Java Suikerindustrie*, Year V, pp. 125-176, Pl. I-III. Surabaia, 1915.

A catalogue and description of the natural enemies of the Sugarcane borers. Of the latter, the following species are known in Java: *Diatraea striatalis* Su, (" Gestreepte Stengelboorder ") ; *Chilo infuscatellus* Sn. (" Gele Topboorder "); *Scirpophaga intacta* Su. (" Witte Topboorder ") *Grapholita schistaceana* Su. (" Grauwe Boorder "). The natural enemies are divided in two groups: egg-parasites, and larva-parasites; among the first, *Phanurus beneficiens* Zehntner attacks the eggs of *Diatraea*, *Chilo* and *Scirpophaga* ; *Trichogramma australicum* Girault attacks *Diatraea* and other injurious insects ; *Trichogrammatoidea nana* Zehnt. attacks *Diatraea* and *Grapholita*. In the list of parasites of the larvae of *Diatraea* and *Chilo*, insects hitherto unknown in Java, are: 1) *Iphiaulax medianus* Cam., *Iphiaulax* sp., *Cremnops parvifasciatus* Cam., *Cremnops* sp., *Mesostenoideus* sp., all in British Guiana ; 2) *Ophion mauritii*, in the Island of Mauritius ; 3) *Tachinidae* spp., in British Guiana and Portorico ; 4) *Licoderma 4-dentatum* common in British Guiana ; 5) an Elater and *Chauliognatus marginatus*, *Drasterius elegans* in Louisiana.

Of importance are: *Telenomus* sp. and *Heptasmicra curvilineata* Cam. enemies, the first of the larvae, the second of the pupae, of *Diatraea* in British Guiana.

In conclusion, detailed particulars are given of the experiments made for the purpose of spreading and breeding *Trichogramma* and *Phanurus*, which are without doubt, the most efficacious parasites for the control of the borers of the sugar-cane.

596 – **The Effect of Cyanide on the Locust-borer (*Cyllene robiniae*) injurious to the Locust-tree** (1). — FLINT WESLEY P. in *Science*, New series, Vol. XLII, No. 1090, pp. 726-727. Lancaster, Pa., 1915.

The researches of F. SANFORD and C. H. SHATTUCK have made it seem probable that at least a part of the borers in infested locust-trees might be killed by introducing small amounts of potassium cyanide into the trunk and bark.

The experiments conducted during 1915, in Illinois by the writer, with potassium cyanide and sodium cyanide gave completely negative results.

The larvae were unhurt and continued to bore and excavate the wood within six inches of the auger holes. The cyanide had a very injurious effect on the trees, the bark was dead and the wood discolored for a varying distance around the holes where it had been placed.

INSECTS INJURIOUS TO VARIOUS CROPS

597 – **The Spring Grain Aphis or "Green Bug" (*Toxoptera graminum*) in America.** — WEBSTER F. M. in *United States Department of Agriculture, Office of the Secretary, Circular* No. 55, pp. 1-3, Figs, 1-3. Washington, D. C., February 5, 1916.

The spring grain aphis (*Toxoptera graminum*) popularly known as the green bug, has appeared in grain fields in Tennessee, Texas, Oklahoma, Kansas, and north-eastern New Mexico. It is probable that the green bug is also in southern Missouri and Arkansas, as it is spreading much further north than usual.

These recent outbreaks have been noted as originating largely in fields of early sown wheat, or in wheat fields following oats, which are attacked by preference and may spring up among the corn, thus attracting the aphids, which in consequence spread to the wheat crop.

The principal natural enemy of *Toxoptera* is *Aphidius testaceipes* which lays its eggs in the body of the green bug, and the young, hatching from the eggs within the body of the host, ultimately cause the death of the "bug".

As a means of control the fields should be carefully watched, and the spots where the grain changes from green to yellow should be ploughed under as deeply as possible and the ground harrowed and rolled. Straw may also be spread over the infested patches and burned.

598 – **Thrips (*Bagnallia oryzae*), n. sp., Injurious to Rice in India.** — WILLIAM C B. in *Bulletin of Entomological Research*, Vol. VI, Part 4, pp. 353-355, Fig. 1, London, February 1916.

*Thrips* (*Bagnallia*) *oryzae* is reported from Madras and described as a new species injurious to rice.

(1) See *B.* Oct. 1915. No. 1103.

599 - ***Philephedra theobromae* a new Coccid Pest of Cacao from Trinidad.** — GREEN ERNEST E. in *Bulletin of Entomological Research*, Vol. VI, Part 4, pp. 377-379, Figs. 1-3. London, February 1916.

Report on and description of a new coccid, *Philephedra theobromae*, found on pods of *Theobroma cacao*; " the insects were enclosed in a carton tent, and attended by the ant, *Azteca chartifex* ", their natural enemy.

600 - ***Agriolimax agrestis*, a Gasteropod causing Injury in Market-Gardens in the State of New-York.** — BAKER COLLINS FRANK in *Science*, New Series, Vol. XLIII, N° 1100, p. 136. Lancaster, Pa., Jan. 28, 1916.

During the summer of 1915, *Agriolimax agrestis* L., caused considerable damage in market-gardens in various localities in New-York State, attacking the subterranean as well as aerial portions of the plants. At Canandaigua and Rochester it damaged potatoes by hollowing out large galleries in the tubers ; at Cyracuse, it was found attacking cauliflowers and lettuce together with *A. campestris* (Binney).

601 - **Animal Pests of Fruit Trees in New South Wales.** — FROGGATT W. W. and GURNEY W. B. in *Department of Agriculture, New South Wales, Farmer's Bulletin*, No. 92, pp. 27-47, with Figures. Sydney, 1915.

A catalogue of the animal pests most injurious to fruit trees in New South Wales, with illustrative notes on their life history, distribution and on the amount of damage they cause.

" Codling Moth " (*Carpocapsa pomonella* Linn.). The adult insects appear towards the beginning of October at blossoming time, copulate and lay their eggs on the apple flowers ; the larvae hatched from these eggs penetrate the fruit as it forms, destroying the seeds and spoiling the pulp. About half the apple harvest is ruined every year in this way. For controlling this insect, such good results have been obtained in these last years with arsenate of lead, that the Government has made a law for rendering obligatory the use of that insecticide in the appropriate seasons. The first application should be given within five days of the shedding of the petals, and the others successively in the fourth, sixth, ninth and tenth week after the flowering is ended. " Woolly Aphis " or " American Blight " (*Schizoneura lanigera* Hausm.) appears on apple trees in the summer and spreads rapidly when the leaves fall and the first winter rains begin. The insect cannot resist hot or strong winds, and frequently in the West many dead insects are found lying at the foot of the trees after a period of hot winds. The mild climate of New South Wales is favourable throughout the whole year for the development of this aphid, whose natural foes, including *Leis conformis*, do not constitute a sufficient check to its spread. The best control for *Schizoneura lanigera* is, besides the use of the usual insecticides, the introduction of resistant types, upon which other varieties might also be grafted. " Northern Spy ", brought over from America, has shown itself completely immune, and the " Majetin " variety has also proved very satisfactory.

During the spring and early summer of 1913-14, a parasite apparently identifiable as *Thrips tabaci* appeared in large numbers on apple, pear,

and other fruit trees in blossom. The damage caused was most serious, the fruit did not form and the harvest was reduced by 75 per cent. The least injured were the early varieties. The virulence and extent of the attack may be explained by the climatic conditions which were unusually favourable : a mild winter and a warm dry summer up to October. As means of control the application of tobacco extract and soap is advised ; good results were also obtained with benzol, which has the advantage of killing the insects and at the same time not injuring even the tenderest shoots.

" San Jose Scale " (*Aspidiotus perniciosus* Comst.) on apple, pear, cherry, plum, peach, apricot, almond etc.

" Mussel Scale " (*Mytilaspis pomorum* Bouché) on apple and pear.

" Apple Root Borer " (*Leptops hopei* Schon.) on apple, vine and other fruit trees.

" Pear and Cherry Slug " (*Selandria cerasi*), on pear and cherry.

" Brown Apple Moth *Cacoecia responsina* (*postvittana*) Walk. — Is common on apple in South Australia, in Victoria and in New South Wales.

" Shot hole Borer " (*Xyleborus solidus* Eich.). Injurious to apple, pear, and plum. As means of control : cut away and burn all infected parts ; manure abundantly to stimulate growth and strengthen the plants so as to resist attack ; apply a solution of carbolic acid and soap.

*Bryobia pratensis* Garman. — Attacks and injures apple and pear. Damp weather is unfavourable to this insect, dry weather favours its growth and spreading. As control it is advisable to use sulphide of calcium, applying it at the end of the winter and in early spring so as to kill the eggs and newly hatched larvae.

" Pear-leaf Blister Mite " (*Eriophyes* (*Phytoptus*) *pyri* Pgst.) — On apple and pear. As control, apply kerosene emulsion or sulphide of calcium after the leaves have fallen in early winter, repeating the operation if necessary at the end of the spring before budding time.

" Pear and Cherry Tree Borer " (*Cryptophaga* spp.). — Are injurious to pear and cherry ; it is easily controlled with kerosene.

" Fruit Fly " (*Ceratitis capitata* Wiedm.) Generally on peach, orange, and less frequently on pear and apple (in New England). Means of control : 1) gathering the infected fruit either for destruction or for boiling so as to prevent the emergence of the larvae ;

2) dig deeply and frequently into the ground, turning it up so as to expose the pupæ hidden in the soil.

" Painted Acacia Moth " (*Teia anartoides* Walk.). — Damages the foliage of cherry, apple, rose, pelargoniums and other orchard and garden plants.

" Emperor Gum Moth " (*Antheraea eucalypti* Scott.). — Feeds on *Eucalyptus* leaves but is occasionally found on apple.

" Grey-streaked Climbing Cutworm " (*Prodenia littoralis* Boisd.). — Occasionally attacks apple and may be controlled effectually with applications of arsenate of lead.

602 – ***Recurvaria nanella*, Micro-lepidopteron Injurious to Fruit Trees in Italy** (1). — MIGNONE A. in *Rendiconti della Reale Accademia dei Lincei, Classe di Scienze Fisiche, Matematiche e Naturali*, Vol. XXV, Part 3, 1st Half-year, pp. 188-195. Rome, 1916.

In the first fortnight of March 1915 small red brown larvae were noticed in the orchards and gardens of Rome that injured the flowers of peach trees. They were recognised as the larvae of a micro-lepidopteron later identified as *Recurvaria nanella* Hb. Nearly all fruit trees of the family of *Rosaceae* are the host-plants.

The moths are very small and begin to appear after the middle of June, they are most numerous in the first half of July. They remain during the daytime almost motionless with closed wings in the bark-fissures of the trunk and larger branches. The young larvae appear towards the end of August; in the Roman orchards and gardens they feed principally on the leaves of peach and apricot; to a lesser degree they may be found also on cherry, morello cherry, apple, quince and pear. The almond tree and hawthorn are entirely immune. The young larvae penetrate into the leaf by a tiny circular puncture in the under surface, preferably near a vein, or in the angles formed by the veins. When inside the leaf they excavate short and thread-like galleries which are usually straight at first and then become tortuous, branching into different directions. The small caterpillars feed on the green parenchyma of the leaf leaving the epidermis intact, but cause the veins to wither at the places crossed by their galleries. When the bad season arrives they retire into the cracks and crevices of the bark where they hibernate in a small cocoon. The young larvae emerge from these winter coverings at the time when the host-trees begin to blossom and, in search of food, climb up to the flower-buds, where they make their round, slightly oval puncture at the insertion of the peduncle. The puncture penetrates through the various coverings to the centre of the bud, *i. e.*, to the gynaeceum, where the pistil is attached to the axis o the receptacle. Besides the flowers buds, the larvae attack also the leafbuds and the tender unopened shoots. Entering the young sprouts they spin silken threads round the tiny leaves binding them strongly together and hindering their normal growth and development. The shoots become deformed and this deformation becomes more marked as the leaves tend to unfurl. In addition the larvae nibble the leaves more or less extensively and do not even spare the veins.

The caterpillars remain on the green parts of the plants until about the end of April, and afterwards migrate to the woody parts to hide in the bark, when, finding a convenient place, they spin a tiny white cocoon and pupate.

603 – ***Plesiocoris rugicollis* and *Orthotylus marginalis*, Capsids Injurious to Apple Trees and Fruit in England.** — FRYER J. C. F. in *The Journal of the Board of Agriculture*, Vol. XXII, No. 10, pp. 950-958, Figs 1-4. London, January 1916.

*Plesiocoris rugicollis* and *Orthotylus marginalis*, two hemiptera of the family *Capsidae*, are extremely injurious to apple trees and fruit in England.

(1) See (1914, No. 804) *B.* Aug. 1914. (*Ed.*).

After these insects have punctured the tissues of the plant in order to suck up its juices, the portions of the plant surrounding the puncture appear as if poisoned and either die or undergo an abnormal development. The leaves at first show scattered red or brown spots which later die and frequently drop out, leaving an undersized and ragged leaf which is incapable of doing its share in supporting the plant. The terminal-shoot on each branch suffers most severely, and there is, in consequence, an excessive production of short lateral twigs which often give a characteristic appearance to attacked-trees. The fruit in mild cases becomes distorted, some parts failing to develop, others growing abnormally so that there are scattered pits and pimples over the surface. The skin shows rough discoloured areas sharply divided from the normal parts. The flesh underneath becomes shrivelled, rendering most of the fruit unsaleable.

Not all varieties suffer in the same degree: Bramley's Seedling and Early Victoria ("Emneth Early") do so but slightly. Allington, Pippin, Beauty of Bath, Gladstone, Grenadier, King of the Pippins, Lanes' Prince Albert, Lord Derby, Lord Grosvenor, and Worcester Pearmain are usually seriously injured.

Both *Plesiocoris rugicollis* and *Orthotylus marginalis* are natives of the British Isles and are widely distributed in almost every County, but mostly in the Counties of Cambridge, Suffolk, Kent, Sussex, Worcester, Hereford, Devon, and Cornwall. Formerly they were said to feed on willow and sallow, and to a lesser degree on alder and hazel. Apple as a food plant seems to have been only recently added to the series of host-plants. Spraying with nicotine and soap is advised as a satisfactory means of control.

604 - **Banana (*Musa* spp.) as a Host Fruit of the Mediterranean Fruit Fly (*Ceratitis capitata*) in the Hawaiian Islands** (1). — BACK E. A. and PEMBERTON C. E. in *Journal of Agricultural Research*, Vol. V, No. 17, pp. 793-804, Pl. LIX-LXII. Washington, D. C., January 24, 1916.

The banana export trade of the Hawaiian Islands having lately become very important, it has therefore become imperative to take any necessary precautions for the protection of mainland fruit interests against any possible infection.

The Mediterranean fruit fly, (*Ceratitis capitata* Wied.) attacks ripe bananas and lays its eggs in the peel, from whence the larvae on emerging penetrate to the pulp and cause it to rot.

The unripe green fruit is not attacked. The peel when green is so surcharged with sap laden with tannic acid that the slightest scratch produces a flow of this fluid which kills the eggs, or hinders the female from depositing them.

The thin skinned Popoulu and Moa varieties (*Musa* spp.) are more frequently attacked by the insect, while the Chinese banana (*Musa Cavendishii*) and the Bluefield banana (*Musa* sp.) are almost completely immune to attack.

(1) See, *B.* April 1916, No. 484. (*Ed.*)

Not 1 out of 1,044 fruits of the Chinese banana ripening singly and prematurely in most favourable conditions for the purpose of oviposition, was found to be infested. From the facts stated, the writers believe that bunches of Chinese banana and Bluefield banana, when properly inspected for the removal of prematurely ripe, cracked or partially decayed fruits, offer no danger as carriers of *Ceratitis*, provided they are wrapped and shipped in accordance with the demands of the trade and the Federal regulations.

605 – **Observations on the Life Histories of some Insects Injurious to Pine Trees, in the State Forests of the Province of Minsk (Russia).** — BORODAEWSKIJ P. in *Liesnoj Journal* (The Forestry Review), Year XLV, Part 8-9, pp. 1222-1247. Petrograd, 1915.

These observations were made in the pine-woods of Mukhoiedowsk on the following insects injurious to pine trees: 1) *Myelophilus minor* Hart.; 2) *M. piniperda* L.; 3) *Ips sexdentatus* Börn.

The most detailed observations were made on *M. minor*.

Having elucidated the most obscure points of the life history of this last insect, the writer says that its development comprises the following eight phases: 1) egg; 2) larva under the bark; 3) larva in the nest; 4) pupa; 5) young insect in the nest; 6) adult, injurious to the young pine shoots; 7) hibernating insect; 8) egg-laying insect.

As it is most difficult if not quite impossible to control *M. minor* when in phases, 3, 4, 5, 6 and 7, it only remains feasible to do so during phases 1, 2 and 8, during wich *M. minor* is ensconced under the bark of the attacked pine trees. The writer says that all works on the subject advise the destruction of the insect when in the larval stage, while the egg-laying insect receives no attention; on the other hand, the study of the tife-history shows that special attention should be paid precisely to this last stage.

With regard to this phase of the insect's life, the writer points out that: 1) *M. minor*, during its life cycle injures the pine trees twice; the first time on emerging from the cocoon in the year of its birth, the second after laying its eggs in the year following; 2) in controlling the insect it is necessary to destroy not only the future but the present generations, the barking of the attacked trees should therefore be done at the time when the adults lay their eggs.

Lastly, the writer reports an observation that may be useful in controlling the insect: in the parts of the felled trees exposed to the action of the sun no adults were found in the galleries, while in parts always in the shade they were found in considerable numbers. From this fact, which, in the writer's opinion, should be better investigated, it might be concluded that to destroy *M. minor*, which attacks the lower side of the felled trees lying on the ground, it would suffice to turn the trees in such a way as to expose the greater part of the insect's galleries towards the sun. If this conclusion is confirmed by further observations, this practice may prove very useful in case of a great diffusion of the insect, for example after a great storm, when the barking of the trees might be difficult to carry out on the many that fall.

606 – ***Ripersia resinophila*, a Coccid Injurious to Pine Trees in the Himalayas.** — GREEN E. E. in *Bulletin of Entomological Research*, Vol. VI, Part 4, pp. 395-397. Figs. 1-3, Pl. XVII. London, February 1916.

A new species reported and described. *Ripersia resinophila* was found on *Pinus longifolia*, at Kumaon in the Himalayas; and on *Pinus excelsia*, in the division of Kamaraj, Kashmir. It attacks young plants. The young Coccids on hatching, at first crawl up the twigs and ensconce themselves between the pine needles in which they feed. Badly affected trees grow very little in height, only in thickness. The pest is not absolutely confined to young plants, but is found also, though less frequently, on branches of large trees. It is much attacked by Coccinellidae and parasitic Hymenoptera, while ants swarm on badly affected trees.

The writer's attention was first called to the insect by Mr. C. M. Mc Crie, who found it in abundance at Takula, Binsar, Bhowali and Ramgarh (all in Kumaon). It appears commonest on hot sunny hillsides, at elevations between 4,000 and 5,800 feet.

607 – **Report on Insects Injurious to Flour and Grain in the Province of Ekaterinoslav (South Russia) in 1915.** — WITKOWSKIJ N. in *Khosiaistwo*, Year XI, No. 3-4, pp. 51-59. Kieff, 1916.

The report presented by the author to the Conference of November 21, 1915, on protecting flour and grain from the attacks of *Calandra granaria* L. and other harmful insects, contains: the description of these insects found in the province of Ekaterinoslav; observations made regarding their life history, and the methods of control used by the Ekaterinoslav organisation for the provisioning of the army.

The accumulation of large quantities of grain and flour in railway and private warehouses greatly contributed to spread of insects harmful to those products.

During the spring and summer of 1915 the writer found the following species: 1) *C. granaria* L.; 2) *Tribolium confusum* Duv.; 3) *Tenebrio molitor* L.; 4) *Silvanus surinamensis* L.; 5) *Laemophloeus testaceus* L.; 6) *Tenebroides mauritanicus* L.; 7) *Ephestia kühniella* Zell.; 8) *Plodia interpunctella* Hb.; 9) *Asopia* (*Pyralis*) *farinalis* L.

*C. granaria* was found among wheat (the most damaged) and also among rye and oats.

Large quantities were found in one of the railway warehouses visited. The researches carried out on some thousands of grains have shown the percentage of damage to be from 8 to 10 % and the loss in weight 65 %.

The following observations were made;

1) When the grain is stored in sacks, the multiplication of the insect is hindered by the adults not being all able to escape from the sacks, further the fertilised females do not all succeed in penetrating into the sacks to lay their eggs; 2) when the grain is stored in the warehouses in heaps, the activity of the insect finds an obstacle in the depth of the layers of grain; this has been proved by the fact that the insects have been found only in the upper parts. The writer gives an example of this in the case of a grain heap, which had been stored for 12 years, where *C. granaria* only in any

quantity about 0.6 to 0.7 m. deep, was found in the upper stratum while in the lower strata the grain was perfectly sound.

For preventing the damage, caused by *E. granaria* the writer advises the refusal of grain infested by the insect and containing more than 13 ½ per cent of moisture, the excess of moisture being most favourable to the insect's development. According to the researches of STRAKHOW-KOLTCHINE, entomologist of the province of Voronech, *C. granaria* not only does not multiply in grain containing a small degree of moisture, but even those individuals that succeed in reaching it die out rapidly.

With regard to *Ephestia Kühniella*, the writer states that it has spread enormously and is a dangerous pest of wheat-flour. Though the writer's researches are still incomplete yet they prove that not all flour is infested by the insect, and what was attacked originated from a certain number of mills where *E. Kühniella* was abundant. It has also been proved that the larvae emerging from the eggs deposited by the females on the outside of the sacks, penetrate the sacks themselves and form nests in the flour by connecting together the larger particles with silken threads. When, however, the time of transformation from larva to chrysalis approaches, the larvae try to escape from the sack. *E. Kühniella* like *C. granaria*, needs freedom for successful fertilisation and oviposition. The larvae work themselves out of the sack with their mandibles passing between the threads without injuring the cloth. The larvæ do not all succeed in escaping from the sack and the moths die unfertilized in the flour. The transformation into chrysalids lasts from one to two weeks. Great numbers of *E. Kühniella* moths were observed from the middle of July to the middle of August.

It is interesting to note that during the months of August and September a great mortality was observed among the larvae of the insect; caused by a small endoparasite as yet not identified. The writer has been able to observe some cases of this endoparasite laying its eggs in the bodies of the larvae of *E. Kühniella*. The larvae which covered the flour-sacks lying at the Ekaterinoslav station were all dead, and the writer obtained from them a parasite belonging to the same species he had observed in the warehouses laying its eggs in the larvae of *E. Kühniella*.

As a means of defence the writer advises sifting the flour as soon as the cold season begins, and its immediate removal from the mills. As the larvae of *E. Kühniella* live in nests it is most probable that the sifting would remove the larvae, together with their nests and larval-refuse. The system of sifting the flour was applied at a mill in the province of Ekaterinoslav and has given very good results both from an hygienic and an economic point of view. The operation costs about 4d to 5d per 220 lbs. of flour.

ALFREDO RUGGERI, *gerente responsabile*.

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

# INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (*Ed.*).

FIRST PART.

# ORIGINAL ARTICLES

## The Selection of Cereals in Italy

*By*

Dr. GIOVANNI PATANÈ

*of the Italian Ministry of Agriculture.*

This article deals in particular with the work of selection and hybridisation carried on in various agricultural institutions in Italy.

1. — " R. STAZIONE SPERIMENTALE DI GRANICOLTURA ", AT RIETI. — In 1903 there was founded, at Rieti, a "Cattedra sperimentale di granicoltura " (Chair of experimental cereal culture), converted later, by the law of the 6th June 1907, into the " R. Stazione sperimentale di granicoltura ". It was from the outset, and is still, directed by Professor NAZZARENO STRAMPELLI, whose name was already known in connection with important hybridisation work begun in 1897.

At the Rieti Station, he first and foremost took in hand the improvement of the well-known " Rieti " wheat which, though held in high esteem owing to its rust resisting powers, was nevertheless of poor cropping value, being very liable to lodge. Having observed that resistance to lodging depends on the number, arrangement and shape of the vascular bundles in the culm (1), Prof. STRAMPELLI satisfied himself that he would be unable to attain the object in view by means of selection alone; without neglecting pedigree selection, therefore, he took up the work of hybridisation, which seemed to him indispensable in order to combine in a new variety of wheat the two qualities: resistance to rust and resistance to lodging. The results obtained by hybridisation, in contrast to those yielded by pedigree selection, enabled him to state that with sufficient patience and

(1) *Rendiconti della R. Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali.* Extract from Vol. XVI, 1st Half-year, Series V, Part 2, Meeting of the 20th January 1907: Experiments on the selection and hybridisation of wheat and maize. Note by Dr. N. Strampelli.

perseverance, the desired object can undoubtedly be secured on this method. He is far from denying that with pedigree selection alone there may be the likelihood of obtaining excellent kinds, but this result is chiefly possible when the investigations bear upon a material not true to stock ; in other terms, a material in which spontaneous cross-fertilisation may have taken place. Such cross-fertilisation, though not possible, it is true, in wheat cultivated under normal conditions, is on the other hand anything but rare when southern kinds of wheat are cultivated in countries which are too northerly for them, and where excessive cold and moisture may readily lead to the atrophy or sterility of their anthers. Therefore, the desired result can only be attained with certainty by hybridisation ; a proof of which may be found in the fact that the celebrated Institute of Svalöf, the birthplace of pedigree selection, has for some years now resorted to hybridisation to make good the deficiency found when the matter was left to chance.

In the extensive experimental fields placed at the disposal of Prof. STRAMPELLI since the foundation of the " Cattedra sperimentale ", the work of selection and improvement of " Rieti " wheat, and other varieties, was undertaken along three different lines :

1) Physiological and methodical selection of the " Rieti " wheat.

2) Acclimatisation (assisted by selection) of the best foreign kinds in the Rieti plain, with a view to imparting to them rust-resistant qualities.

3) Hybridisation between different species and varieties with a view to fostering variations, in order to fix new types or kinds of wheat superior, in rust and lodging resistance and in yield, to the kinds previously obtained.

The crosses made with successive generations yielded by segregation many thousands of forms, the most interesting of which are being studied and where possible, fixed. Prof. STRAMPELLI has also obtained a number of new types of maize, which are being studied and fixed as far as possible.

The Station has at present 3 experimental fields under different meteorological conditions :

1) Rieti Field, in a locality the climate of which is made very moist by the abundant fogs and the spring and summer dews. The chief object here is to produce types of wheat resistant to rust and lodging, and at the same time capable of the highest yields, especially in the valleys of central and southern Italy.

2) Field of Foggia, where the aim is to produce wheats and oats that will thrive in the arid climate of Apulia.

3) Field of Leonessa (at about 1000 metres altitude) intended for the production of new varieties of wheat, barley, rye and other cereals, suitable for cultivation in hilly and mountainous regions.

In the investigations carried out on these three experimental fields, the method by selection of the " small species " according to the idea of JORDAN, and the method by hybridisation were followed. Table I gives the pure pedigrees of some of the most important wheats.

TABLE I. — *Pure Pedigrees of some Important Wheats.*

| | Pedigrees begun | Pedigrees definitely discarded | Pedigrees still under trial |
|---|---|---|---|
| "Rieti" | 298 | 173 | 125 |
| "Gentil Rosso" | 81 | 40 | 41 |
| "Shireff" × "Cologna" | 43 | 31 | 12 |
| "Maiorca" | 26 | — | 26 |
| Various soft wheats | 481 | 236 | 245 |
| Various pollard wheats | 16 | 12 | 4 |
| Various hard wheats | 70 | 59 | 11 |
| Totals | 1015 | 551 | 465 |

Among the pedigrees which were kept, some, which constantly gave excellent results, are highly interesting. There may be mentioned, for example :

1) A "Rieti" designated as number 745, which, for several years showed resistance to lodging, and a productivity superior (as much as 6 to 7 ½ bushels per acre) to those of the original "Rieti" and all the other pedigrees of this stock isolated.

2) A "Gentil Rosso", numbered 9, more rust-resistant and constantly more productive (4 ½ to 6 bushels per acre) than the original type from Montevarchi and the other pedigrees of this kind isolated by the Station.

3) Two pollards (1 "White pollard" known as "Pétanielle" and 1 "Red pollard"), which, though the grain produced was of inferior quality for bread-making, gave, in 1912, the exceptional yield of 81 bushels per acre.

In all, up to the end of 1914, 273 crosses were carried out between native and foreign wheats, and from them were obtained 1,288,924 possible types according to the calculations of the probable groupings of the antagonistic characters of the parents. Among these types there were taken in hand 4,776, of which 3,690 were discarded in the course of several years, so that at the end of 1914 there remained, including the crosses last created, 1,086 forms under study, some of which have given good results for several years and are at present being grown in bulk. In the very first rank are the following :

1) "Gregor Mendel" Wheat, designated as No. 133 among the 256 types obtained by the cross "Rieti" × "Principe Alberto". It is resistant to rust and lodging, and yields as much as 52 bushels per acre.

2) "Carlotta Strampelli" Wheat, type No. 637 among those obtained from the cross "Rieti" × "Massy". This wheat, rust and lodging resistant, gives yields exceeding 70 bushels of grain per acre.

Among the drought-resistant wheats, particular mention must be made of: "Dauno" (a hard wheat), "Gargano" (a soft beardless wheat), and "Apulia" (a soft bearded wheat) resulting from the cross "Rieti" × "Spelt white bearded".

Before distributing these last 3 wheats, they must again be submitted to fresh tests in order to establish their merits beyond dispute.

Prof. STRAMPELLI has also endeavoured to produce early varieties, and has already obtained important results.

For wheat, in addition to crosses between different varieties he has also made crosses between species and even between different genera.

The crosses shown in Table II are examples :

TABLE II. — *Principal Crosses between Different Species or Genera.*

| | | | | | |
|---|---|---|---|---|---|
| *Triticum turgidum* | × | *T. durum* | *T. dicoccoides* | × | *T. villosum* |
| *T. durum* | × | *T. polonicum* | *Aegilops ovata* | × | *T. villosum* |
| *T. sativum* | × | *T. spelta* | *T. polonicum* | × | *T. villosum* |
| *T. sativum* | × | *T. dicoccoides* | *T. sativum* | × | *Aegilops triuncialis* |
| *T. sativum* | × | *T. amyleum* | *T. sativum* | × | *A. ventricosa* |
| *T. sativum* | × | *T. villosum* | *T. sativum* | × | *Secale cereale* |
| *T. amyleum* | × | *T. villosum* | *Hordeum nutans* | × | *H. bulbosum* |

These crosses yielded not only many interesting observations from the scientific standpoint, but likewise practical results, such as the creation of new species, namely :

*Triticum giganteum*, with very large ears, bearing grains almost equal in size to the coffee berry.

*Triticum furcatum*, which bears long prong-like awns similar to those of *Hordeum furcatum*.

Prof. STRAMPELLI is also conducting investigations in respect to the following cereals :

1) *Barley.* — There have been obtained about 170 new kinds of the very highest value, one of which, particularly productive, attained in 1914 a yield of 73 bushels per acre on the elevated plateau of Leonessa.

2) *Oats.* — From the cross *Avena sativa* × *A. fatua* there were obtained about 200 new types, some of them very promising as regards productivity and above all as regards power to withstand the dry climatic conditions of the region of Foggia.

3) *Maize.* — Various crosses made with a view to obtaining very early and very productive kinds, with reduced vegetative growth, have yielded an exceedingly large number of new types, of which about 300 are at present under observation; some of them ripen at Rieti about the middle of August, and have given yields of 47 to 50 $^1/_2$ cwt. per acre.

4) *Rye.* — This is also being studied, but no noteworthy result can be mentioned as yet.

The work of the Station of Rieti has been extended to other plants also, namely : pulses, potatoes, pumpkins, tomatoes, certain woody plants, etc.

We may add that Prof. STRAMPELLI endeavours not only to give the new kinds an indisputable cropping value, but also, when possible, to impart

peculiar characters which may distinguish his creations. Thus, for instance, in addition to the wheat " Carlotta Strampelli ", he has obtained : the greyish-green lentil, two-coloured potatoes, lucerne with white flowers, with iron-grey flowers, greenish flowers, etc.

In view of the good results obtained at the Station of Rieti with some of these varieties of wheat, the Ministry of Agriculture in 1915 established under the direction of Prof. STRAMPELLI several experimental fields in different regions as adjuncts to agricultural institutions in Central and Southern Italy, in order to compare the varieties produced at the above Station with other wheats under extensive cultivation. The results of these comparisons pointed everywhere to the following conclusions :

1) The wheat " Carlotta Strampelli " exceeded all others with regard to yield (30 to 50 bushels per acre).

2) The wheat " Carlotta Strampelli " is the one most resistant to lodging, and to rust and other fungoid diseases.

Although the above results have been carefully checked, Prof. STRAMPELLI, before distributing this important quality of wheat to the public, will next season repeat the tests in the various regions, in order to determine the best time for sowing and the most suitable quantity of seed for each of the different localities.

The work thus briefly reviewed was accomplished in less than 10 years and has earned well-deserved praise from well-known scientific agriculturists and scientists, among whom mention may be made of LOUIS PHILIPPE VILMORIN, who hold a very favourable opinion on the work of Prof. STRAMPELLI.

In addition to its work of selection, the Rieti Station has carried out a series of important investigations and experiments relating to the following questions: manures, rust diseases, parasites of cereals, transplanting of cereals, preparation of cultures of root bacteria of the French Honeysuckle (*Hedysarum coronarium*), etc.

II. — " SOCIETÀ ANONIMA COOPERATIVA BOLOGNESE PER LA PRODUZIONE DI SEMENTE DELLA GRANDE COLTURA ". — On the initiative of Professor TODARO and under the auspices of the Society of Agriculture of the province of Bologna, the foundations were laid in 1908 of an " Istituto di allevamento delle piante agrarie " (Institute for agricultural plant breeding), directed by Prof. TODARO himself. The object of this Institute was to conduct selection work for the special purpose of " individualising a very small number of kinds of wheat best calculated to meet the requirements of cereal cultivation in the province of Bologna ".

As the fundamental guiding line for his work, Professor TODARO adopted the idea of " small species ", " physiological " or " JORDAN " species, which leads to the chief importance being attributed to the first process of sorting out, the latter having of course, at the outset of the work, to be made in ordinary cultivated fields. On the whole, Prof. TODARO follows the method of pedigree selection practised at Svalöf, and afterwards proceeds to the selection and pure cultivation of the types presenting most value.

After the work of selection had successfully accomplished its first

phase, in July 1911, the above Limited Cooperative Society of Bologna was formed for the production of seeds for extensive cultivation, and in the agricultural year 1912-1913, the seeds resulting from the first growth were obtained on a commercial scale. In the following years, there were fixed and grown many wheats of the types of : " Rieti ", " Cologna ", " Masolino ", " Bordeaux ", " Gentil Rosso mutico ", " Gentil Rosso aristato ", " Inallettabile " (Non-lodging), " Turgido d'Australia " (Australian rivet).

The separation and breeding are now accomplished facts and growing in bulk on a commercial scale has already been undertaken : in 1914 the Society sold more than 49 tons of seeds, and its members took 29 tons.

With a view to promoting the spread of physiologically selected races in Latium, and introducing in that province the varieties esteemed elsewhere, the Ministry of Agriculture instructed Professor TODARO to make similar trials of selection and adaptation in that region ; they were begun in the agricultural year 1913-1914 by isolating and breeding 255 lines of wheat and 192 of oats derived from local cultivations on the HOPKINS method, as well as " cinquantino Pelò " maize and " Pignoletto " maize for poultry, and finally by instituting some trials for adapting to ordinary cultivation, " Kirsche " oats, " Saragolla " wheat, 1 rivet wheat, 3 types of " Rieti " wheat, and 2 wheats of the " Cologna " type — physiologically pure races obtained by the above Society

From the best of the progeny the material was derived with which, in 1913-1914, the trial breeding was begun for the choice of the best lines, which in their turn are being subjected, in 1915-1916, partly to a production test, and partly to a regional test. From the results obtained hitherto, the following conclusions may be derived :

1) In a short time, there will be placed at the disposal of farmers in Latium, a small number of physiologically pure races of wheat suited to the environnment, characterised by high productivity and by resistance to rust and lodging.

2) The best type of the common " Avena romana " will soon have been segregated.

3) Next year it will be possible to hand over for bulk cultivation 2 valuable pure races of maize : one with grains very rich in starch, specially suitable for feeding cattle; the other with grains rich in gluten, particularly adapted for human food.

Finally, Prof. TODARO proposes to assist in extending the cultivation of brewers' barley by segregating the lines which will have been found most appropriate to the Roman Campagna.

III. — " R. STAZIONE AGRARIA ", MODENA. — At this agricultural Station, wheat selection work was begun in 1910, and is still continued under the direction of Prof. G. LO PRIORE and his assistant, Dr. G. D'IPPOLITO.

The method of pure lines is adopted, obserwing the following principal points :

1st *year* : First choice of the parent heads, in a common field.

2nd *year:* Comparative tests of the progeny of these heads, the grain of which is sown and cultivated separately.

3rd *year:* Cultivation in bulk of the selected progeny

The initial selection of the heads took into account the cropping power and resistance to rust and lodging, and was made from the following wheats: " Gentil Rosso ", " Rieti ", " Cologna Veneta ", " Polese " (" Colognese del Modenese "), " Noé ", " Shireff ", " Rosso Olona ", " Quattrocoste ", " Maiorca rosso ". Altogether 209 heads were chosen, and the grain sown on 209 plots of 1 square metre to the number of 39 per plot. After the heads were ripe, the number of families reckoned as good was reduced to 10 only, namely: 3 " Gentil rosso ", 1 " Quattrocoste ", 2 " Rieti ", 1 " Polese " and 3 " Cologna Veneta ".

In 1912 these families were subjected to the first trial growth in bulk, then, in 1913, a second bulk trial was made and good results were obtained as regards yield of grain. In 1914 a third bulk cultivation was made, discarding the " Polese " wheat, which showed insufficient resistance to rust and had not come up to the expectations based on the results of previous years (though it must be remembered that in 1914, throughout Italy, the season was unfavourable to grain formation). In 1915 only the " Gentil rosso " was cultivated in bulk, and was found very promising. On the other hand, the " Rieti " and " Cologna ", holding out little prospect of success, were definitely abandoned. At present 6 families of stand-up hybrid wheats are being bred, which were marked out in a group of 79 of the previous year, and from which good results may be expected.

In addition to the wheat selection trials, tests are in progress for the acclimatisation of different kinds of Scotch wheat and oats: these will serve as the point of departure for other work.

IV. — " R. Scuola Superiore di Agricoltura ", Milan. — In this higher School of agriculture, selection is studied and practised by Prof. Ugo Brizi and Dr. B. Venino.

In his studies, Prof. Brizi devotes himself specially to phenomena of cleistogamy and parthenogenesis, together with their consequences in applied genetics. Other work in progress has for its object to solve (if this can be done with precision) the question of the inheritance of acquired characters, by means of a clearly proved natural process. The results hitherto obtained may be considered as excellent and will be published after renewed checking.

Special attention has been paid to the Cruciferae and the Chenopodiaceae in the course of breeding work, all the cleistogamic and parthenogenetic forms [illegible] tied and tested under cultivation on the Nilsson method [illegible] that aspect of the latter's experiments which was

In addition [illegible] oats, and

particularly in reference to DE VRIES' mutations, the observations must be continued for ten years at least.

Dr P. VENINO has, since 1910, been making experiments of selection with " Rosso Olona " wheat, on the NILSSON method.

After making some thousands of observations, he was able to separate 2 families, the characters of one of which began rapidly to approximate to those of the " Quattrocoste " wheat, while the other varies continuously and also exhibits awnless ears.

During the last season many bulk plots were laid out, yielding as a result, in the case of the " Rosso Olona " wheat, high tillering power, strength of straw, and weight of grain. In the successive cultivations the weight and bulk of the grain has increased continuously.

In short, Dr VENINO has struck out the right path for improving the wheat " Rosso Olona ", and, by taking his rigorously conducted experiments as a basis, he has every reason to hope that this wheat will be a thorough success (1).

V. — " R. ISTITUTO SUPERIORE AGRARIO SPERIMENTALE ", PERUGIA. — Prof. ALESSANDRO VIVENZA, the director of this higher Royal Institute for Experimental Agriculture, began his selection experiments in 1900.

For 6 years past he has been carrying on a methodical selection of the wheat " Fucense semiduro ". Started on the Nilsson method, it proved that, in the progeny of a given plant, there were marked differences between individuals of the same family, to such an extent that this phenomenon could not be ascribed wholly and solely to the segregation of characters according to Mendelian laws; for this reason it was thought advisable to continue selection on a method approximating to that of HALLET and it was found that this wheat, which is a young strain, might be capable of very marked modifications, exactly as the Darwinian theories would suggest. This observation appears to be confirmed by the results of another experiment made with the " reversible Vilmorin Wheat ".

VI. — " R. ORTO BOTANICO E GIARDINO COLONIALE ", PALERMO. — This Botanical and Colonial Garden, under the direction of Prof. A. BORZÌ, has, since 1900, also devoted a part of its activity to work in connection with the selection of some varieties of cereals, beginning with barley (2), on which Dr TROPEA has been working for several years with very encouraging results.

Fresh researches and experiments are proceeding for the purpose of isolating a Sicilian race of wheat resistant to seasonal changes ; other studies cover the following: Coefficient of density — Influence of origin of seeds on acclimatisation — Enquiry into inheritance of recently acquired characters — Influence of time and depth of sowing on drought resistance and on the yielding powers of wheat, barley and oats.

(1) Cf: Dr. P. Venino : 1) " Di alcuni ibridi Garton ", in *L'Agricoltura moderna*, Year 1907, Nos 42 and 43 — 2) " Cereali di primavera ", *Ibid*, Year 1908, Nos 51 and 52 — 3) " Prime notizie intorno ai lavori di selezione del frumento " Rosso Olona ", in *Annuario Ponti*, Vol. XI, 1912-1913, and Vol. XII, 1913-1914.

(2) Cf : C. Tropea : " Risultato di colture selezionate, I. *Hordeum sativum* ", in *Bollettino del R. Orto botanico e Giardino coloniale*, Year VIII, Part 4. Palermo, Tip. Priulla, 1909.

VII. — " R. Scuola Pratica di Agricoltura ", Andria (Bari). — For the selection of wheat, undertaken in 1913, Prof. L. Vivarelli, director of this Practical School of Agriculture, has mapped out a plan directed to improving local varieties and to proving whether, in the droughty climate of this region, varieties from other regions can be acclimatised. The predominating local variety is " Bianchetta di Puglia ", and the varieties introduced from elsewhere are : " Gentil rosso ", " Noé ", " Rieti " and " Vilmorin reversible Wheat ".

As regards the local variety, a short period of systematic selection was applied to begin with, then pedigree selection was adopted, taking the parent heads from a field containing the individuals produced by the systematic selection. At present, after having in the first year chosen the parent heads, the first phase of the second period has been reached, *i. e.*, the beginning of pedigree selection, which is to be followed in the third year by bulk cultivation of the selected progeny.

In any case a first important conclusion may be derived from these tests, namely, that the safest plan is to take in hand the already existing local strains.

In future tests, Prof. Vivarelli will not only continue the work of pedigree selection, but will also carry forward his moulding-up trials, which, in conjunction with physiological selection, have already proved to be the fundamental means for obtaining the new strain of wheat which shall best correspond to the local conditions of climate and soil, and solve the important problem of abundant wheat production.

VIII. — " Istituto Agrario Vegni ", Barullo (Arezzo). — By means of the wheat selection carried out on the estate of the above Agricultural Institute, its director, Prof. Dante Vigiani, has been able to raise the average yield of grain from 17.58 to 25.93 bushels per acre.

Since 1912-1913 he has made it his task to produce by selection a type of " Gentil rosso " more resistant to lodging, and thus to contribute, by careful and assiduous work, to increasing the grain production of that region.

Prof. Vigiani did not confine his experiments to wheat, but extended them successfully to the following plants: oats, maize, beetroot, turnips, hemp, tobacco and forage plants.

IX. — " Istituto Agrario " di Scandicci (Florence). — The Senator Prof. Passerini, founder and proprietor of this Agricultural Institute, has, since 1900, conducted hybridisation tests on the wheat " Gentil rosso ", and has been able to show that the proclivity of this variety to lodging is due to the structure of the culm, this latter having very thin walls, relatively large air space, and remarkable diameter of fibres in the outer sheath (1). To remedy this drawback, he tried crosses between " Gentil rosso " and " Noé " and obtained a number of forms of " Gentil rosso " × " Noé " and " Noé " × " Gentil rosso ". The first of these crosses yielded 50 new forms, of which

(1) Cf : " Ricerche ed esperienze istituite nei poderi sperimentali, nel laboratorio di chimica agraria e nell'osservatorio meteorologico, sotto la direzione del prof. N. Passerini, » in *Bollettino dell'Istituto agrario di Scandicci*, Year 1915. Florence, Tip. G. Ramella & Co.

only 9 were sown separately. From their progeny 4 forms were isolated which resisted lodging admirably.

Prof. PASSERINI is of opinion that, in order to preserve the characters of the new varieties, careful selection must be made every year.

It is an established fact, in any case, that agriculture in Tuscany has derived appreciable benefit from the work of selection conducted by this investigator.

X. — "STAZIONE SPERIMENTALE DI RISICOLTURA", VERCELLI (PIEDMONT). — This Station for Experimental Rice Cultivation, is under the direction of Prof. NOVELLO NOVELLI. It possesses a field for pedigree selection of rice intended specially for acclimatisation tests of new imported varieties, and pedigree cultivation of some varieties to be improved. It has a small meterorological station at which daily observations are made of climatic conditions, the vegetative behaviour of the different varieties of rice and corresponding phenomena, the results being afterwards collated for a series of years.

Prof. NOVELLI endeavoured to produce a first practical improvement of rice by the following means: affording rice growers the collaboration and technical advice of the Station; making known good methods of cultivation; inspecting and directing cultivation; and distributing graded seeds to the most intelligent rice-growers. The result has been that some rice-growers have specialised in the production of pure rice seeds for supplying the market.

The advantages derived from the foregoing by Italian rice-growers have been, and continue to be, most marked, and they will still further increase when the production of pure seeds has been facilitated by the system of transplanting introduced into Italy some years ago with highly promising results. This system obviates spontaneous reproduction of seeds prematurely dropping on the ground owing to various causes, and a pure product is thus secured. Physiological selection has retained and accentuated the best characters of the varieties imported from Asia of late years, which would certainly have degenerated failing this attention. Such was the case, for instance, with the variety "Chinese originario" or "Abbondanza" imported twelve years ago, which now furnishes $^2/_3$ of the Italian crop. It has been possible to maintain its cropping and disease-resistant powers, and even to improve its marketable qualities.

The continued selection operating on one and the same variety has yielded earlier types, particularly suitable for cold and shady waters and soils, and, for later sowing, types with larger grain, longer, and richer in gluten, of higher commercial value, which in a short time became fairly widespread, to the considerable advantage of Italian rice cultivation.

For 3 years the Station of Vercelli has carried on pedigree selection of rice in order to restore the qualities of pure lines to some of the best varieties, namely:

1) Variety "Chinese" or "Bertone", imported from Asia about 1821 into the State of Piedmont: very early, of high commercial value, but insufficiently productive and with a limited yeld of polished grain.

2) Variety " Ostiglia " : has lost a good deal of its resistance to disease and lodging ; limited production, limited yield of polished grain ; on the other hand it is fairly early and of excellent marketable quality.

3) Variety " Chinese originario " or " Abbondanza " : the best of those recently imported, cultivated over very wide areas, highly productive, resistant to the different diseases, but less now than formerly ; on the other hand it ripens late, is easily lodged and of limited commercial value.

Among these 3 selections begun, the most promising is that of the " Chinese originario ". Next year the selection of the 2 first varieties will be resumed and that of 4 or 5 esteemed varieties will be begun. Afterwards, hybridisation of pure varieties will be experimented with.

The Station of Vercelli also intends to organise importation and acclimatisation of new varieties of rice as soon as it has the necessary means.

It may be concluded that this Station, despite its exceedingly limited means, has within a short time furnished brilliant proof of its capacity.

*Conclusions.* From what we have set out, and from what has been published in Italy in relation to the improvement of cultivated plants, the following conclusions may be drawn :

1) In Italy considerable sums have been spent on controlling plant diseases, but very little for direct improvement of plants.

2) The experiments of selection and hybridisation of wheat begun in 1900 took on continuous form in 1905.

3) The Royal Station of Rieti for cereal cultivation has obtained magnificent results, confirmed by all regional tests carried out disinterestedly and with the utmost care by various State Agricultural Institutes. It has furnished a valuable contribution to genetics in general, and to cereal cultivation in particular.

4) The Cooperative Society of seed producers of Bologna has isolated and fixed numerous families of wheat in pure strains, which it has spread through certain parts of Italy, particularly Emilia.

5) The Schools of practical agriculture at Scandicci and Barullo have obtained and spread in Tuscany varieties of wheat of higher yield and more resistant to lodging.

6) In the following establishments : the higher Schools of Agriculture of Milan and Perugia, Royal Colonial Garden of Palermo, Royal Agricultural Station of Modena, and School of Agriculture of Andria, important studies and experiments are being carried on which have for their object the progress of cereal cultivation, particular attention being given to local varieties of wheat.

7) The Vercelli rice cultivation Station has in a few years rendered notable service to agriculturists, and has brought to a successful conclusion important work appreciated by Italian and foreign scientists.

8) As in other departments, Italy has distinguished herself in that of the improvement of plants under extensive cultivation and in that of the application of the biological and chemical sciences to the problem of food supply.

SECOND PART.

# ABSTRACTS

## AGRICULTURAL INTELLIGENCE

### GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES

608 - **Legislative Measures adopted by the Republic of Colombia for Agricultural and Livestock Development.** — I. Ley 75 de 1915 (29 de noviembre) por la cual se fomenta la agricultura nacional, in *República de Colombia, Diario Oficial*, Year LI, No. 15 658, pp. 1745-1746. Bogota, 1st December 1915. — II. Ley 82 de 1915 (30 de noviembre) por la cual se fomenta el establecimiento de carnicerías y refrigeradores (Packing Houses) para la exportación de carnes. *Ibid.*, No. 15 659, p. 1762, December 2, 1915.

I. — Under the first law above cited, the object of which is to foster national agriculture, there will be founded, *inter alia*, Stations of scientific agriculture in suitable localities of the Republic, with the object of carrying on study and scientific experiments ; demonstrations bearing on the application of chemical manures, and the cultivation and acclimatisation of plants ; and also of organising exhibitions of modern agricultural implements and machinery (article 1). — Each Station will have a special department for : agricultural meteorology, agricultural entomology, analysis of soil and water, introduction and distribution of useful seeds and plants, and importation of chemical manures and breeding animals in order to improve local strains ; in short, all that in necessary for the development and progress of national agriculture (article 3). A monthly organ will be issued : *El Agricultor Colombiano*, which will give an account of the work at the Stations and furnish other general agricultural information, which consuls abroad are likewise required to transmit (art. 6 and 8). The Ministry of Agriculture and Commerce will also organise at Bogota, industrial, agricultural and livestock exhibitions for 3 years, and further, similar exhibitions will be held every 2 years in the chief towns of departments, at the expense of the latter (art. 9). There will likewise be founded, as soon as possible a central Institute of Bacteriology in connection with the Stations of scienti,

fic agriculture, thus carrying into effect law 72 of 1914 (art. 10). Model farms may be established in the 3 climatic zones (hot, temperate and cold) of Colombia (art. 11).

II. — The object of the second law is to encourage the establishment in Colombia of meat packing-houses and chilling works for the exportation of cold-stored and canned meat. The plant and machinery imported by these establishments for the exclusive purpose of slaughter and preparing and preserving the meat will be free of import duty, this exemption remaining in force for 2 years from the beginning of exportation. Establishments will pay the departments in which they are located only 10 *centavos* (about 5*d*) per animal slaughtered, instead of the usual slaughtering tax, and will be exempted from all export duties which might be imposed by the Colombian Government, for a period of 20 years from the promulgation of the present law (art. 1). The establishments must be provided with the necessary destructors and disinfecting plant, in order that day by day the offal may be burned or converted into manure (art. 3). Finally, the Government will undertake a census of the cattle in Colombia as soon as possible.

609 - **Agriculture and Livestock in the Spanish Gharb (Morocco).** — VASQUEZ JOSÉ in *La Industria pecuaria*, Year XVII, Nos. 507-512, pp. 491-492, 502-504, 514-515, 529-530 542, 550-553. Madrid February 10-April 1, 1916.

,DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

I. *Soil.* The Spanish Gharb comprises the districts of Arcila, Larache and Alcazarquivir. The rich zones of Garbia, Aiaxa, El Jolot and Tilig, which have an area of about 932 square miles, form part of it. The country is chiefly hilly, the plain being limited to the river valleys. The soils are : 1) mellow alluvial in the valleys ; 2) sandy, reddish yellow in colour, on the hills and mountains ; rich in humus and excellent for cereal-growing ; 3) marshy or briny in the valleys of Maharhar and Haxef and near the mouth of the Ouad-Trahahart (these extensive marshes are known under the name of Tembladeras) and in the valleys of Ouad-Mejazen, Ouad-Ouarour, etc. All these lands are rich in organic matter, with high capillarity, permeable and hygroscopic ; they are easily worked. The analysis of 2 soils : *A* from the valley of Luccus, *B* from the sandy slopes of the Smid-el-Ma, made in the Agricultural Institute of Madrid, yielded the readings shown in the following table.

*Physical and chemical composition of 2 soils from the Spanish Gharb (parts per thousand).*

| Physical analysis | A. Valley of Luccus | B. Smid-el-Ma |
|---|---|---|
| Moisture | 24.50 | 13.43 |
| Organic matter | 56.00 | 59.20 |
| Limestone | 146.60 | 8.86 |
| Coarse sand | 120.00 | 704.86 |
| Fine sand | 461.40 | 177.66 |
| Clay | 209.50 | 40.99 |

| Chemical analysis of the soil dried at 100° C. | A | B |
|---|---|---|
| Nitrogen | 0.99 | 1.37 |
| Phosphoric acid | 2.03 | 1.07 |
| Lime | 83.74 | 5.00 |
| Potash | 1.61 | 0.63 |

II. *Climate.* Moist and temperate; this zone comes within the region of cultivation of the olive tree, in its southern subdivision.

III. *Vegetable Products.* — 1) *Cereals.* The wheats cultivated are chiefly *Triticum polonicum*, and to a much less extent *Tr. durum*; 4-rowed and 6-rowed barley; very little oats; a little maize; a great deal of sorghum and millet; and a small amount of *Phalaris canariensis*.

2) *Pulses.* The chief ones cultivated are: the horse bean (with small but floury seeds exported in large quantities to Andalusia), chick pea, and haricot.

Liquorice grows wild in the fertile valley of Luccus.

3) *Solanaceae*: potato, tobacco, egg plant (this plant, extensively cultivated, produces fruits remarkable for size and sweetness), pimento, and tomato.

4) *Cucurbitaceae*: calabash (a variety with large round fruits), melon, cucumber, and water-melon (very large fruits, the flesh being mostly light red in colour).

5) *Vine.* In the Garb the same varieties (white and red muscat) as are grown at Malaga for making the famous muscatel raisins; in the region of Ahl-Sérif the vine attains to great size and yields very big bunches of grapes.

6) *Olive tree.* There are found here both the large-sized cultivated olive tree and the wild olive, very abundant, and producing an enormous quantity of small fruit from which a fine oil is made.

7) *Fruit trees*: orange (a variety called "lechín", equal to the Spanish "naranjo chino", yields fruits superior to the Andalusian oranges), lemon tree, carob tree (especially in the Wazau territory), pomegranate tree (yields very large sweet fruits and also occurs wild), date palm (attains to great size and exhibits 2 varieties, one with cylindrical and the other with pointed fruits), almond, plum, cherry and quince trees (the latter yields very large fruits); on the other hand, the apple tree, pear tree and peach tree do not thrive. The fig tree, yielding exquisite fruits, is represented by *Morus alba* (very abundant), and the Barbary fig (very abundant; its fruit is used to prepare an alcoholic beverage).

8) *Woods.* The cork tree (*Quercus suber*) grows throughout the zone and in two kinds of soils; it forms entire woods which are termed "Gabas", the natives do not utilise either the acorns or the cork, but only the wood, which they burn.

Among the species which furnish timber for building or other industrial purposes, special mention must be made of: *Callitris quadrivalvis*, (with fragrant wood), *Fraxinus excelsior, Populus alba, Ulmus campestris, Celtis australis*, which attains a great size, and different species of *Salix, Acacia*, etc.

In the thickets and the wooded meadows (which comprise a part of the pasturage) there occur, in more or less close stands : *Pistacia lentiscus*, *Ulex europaeus*, *Chamaerops humilis* (very abundant), *Erica arborea*, brooms, arborescent ferns, etc.

9) *Pasture lands and grass lands.* The principal plants of the pasturages and cleared lands (" eriales ") consist of different species of : *Scorpiurus*, *Silene*, *Raphanus*, *Asphodelus*, *Vicia*, and comprise also : *Onobrychis sativa*, French honeysuckle (*Hedysarum coronarium*) growing wild in the district of Arcila and elsewhere, *Anthyllis vulneraria*, *Avena fatua* and *A. flavescens*. *Arrenatherum elatius* and the yellow lupin cover wide areas.

In the numerous *natural grass-lands* which lie along all the streams there predominate : *Lolium italicum*, *Trifolium repens*, *T. pratense*, *T. perenne*, *Alopecurus pratensis*, abundant in damp places, etc.

The writer advises that intensive cultivation should be promoted in connection with maize, millet, sorghum, *Phalaris canariensis*, rice (in the marshy zone of Smid-el-Ma), the cotton plant (*Gossypium religiosum*) and also grass-lands for stock-breeding purposes.

IV. *Livestock Production.* — 1) *Horses.* There are two clearly distinct types : *a*) the Barbary type ; *b*) the product of a cross between the Barbary and the Arab type. The Arab horse is bred in the interior of the country (in the valley of Ouad-Draà near Tafilat). In the different skeletons of horses examined by the Author the number of cervical vertebrae (7) and that of dorsal vertebrae (8) was constant.

2) *Cattle.* This breed represents a mixture of different or even opposite characters : some of the cattle are brachycephalous, others dolichocephalous ; their horns are small, and stature rather low ; they are fairly good working animals, but poor meat and milk producers. In the region of Anghera the Dutch cow has been imported from Spain, and crossed with the local breed to improve the production of milk.

3) *Sheep.* There are 2 breeds : *a*) Merinos, *b*) Syrian (Asiatic) and their hybrids, both sometimes mingled in the same flock. The sheep of the Merino breed are 31.52 to 33.49 inches in height ; their fleece, very long, white or yellowish, yields a wool of superior quality, which is exported in large quantities via the port of Larache. The Syrian breed is higher in stature and furnishes a less esteemed wool, but its meat is better. The individuals of this breed sometimes have 4 or 6 horns.

4) *Goats.* The goats, which are very numerous, but held in little esteem by the natives, are a variety of the breed inhabiting the southern part of Spain (" cabras costeñas ") ; they are small in stature, with long black hair, and yield little milk.

RURAL HYGIENE

**10 – Observations on 5 North-American Species of Simulium and their possible Action in disseminating Infectious Diseases.** — JOBBINS-POMERY, ARTHUR W., in *United States Department of Agriculture*, Bulletin No. 329, 48 pp., 15 figs., 5 plates. Washington, March 6, 1916.

Certain species of the insects known as " buffalo gnats " (*Simulium*) are considerable pests of man and domestic animals in the United States

as well as in other countries. Although the principal area where they abound in North America is in Canada and the Northern States, the pests of this group occur as far south as Louisiana and Florida. While they are dependent on running water for development (48 hours in stagnant water sufficing to kill the larvae), they make use of very small streams and to some extent of irrigation ditches, and are consequently found occasionally in considerable numbers on the drier parts of the country.

About twenty years ago, buffalo gnats attracted great attention along the lower Mississippi : they frequently became so abundant that plantation operations were stopped on account of very painful attacks against livestock as well as human beings. These great outbreaks were due to conditions produced by the overflow of the Mississippi river. The perfection of the levee system has changed these conditions, so that the outbreaks are less frequent and of greatly reduced severity. The damage done by buffalo gnats results from their painful bite and the loss of blood which ensues. When they are abundant they sometimes cause the death of livestock. At the present time no cases of disease transmission can be attributed definitely to buffalo gnats, but there is the possibility that future investigations may prove them to be transmitting agents of some infectious diseases (virulent anthrax, *Psoriasis guttata*, chicken and hog cholera, and pellagra). The study of their biology is of great practical importance, and was carefully carried out by the Author in regard to 5 species : *S. venustum*, *S. vittatum*, *S. bracteatum*, *S. jenningsi* and *S. pictipes*. The following are some of the results :

A female lays the maximum number of 500 eggs. The number of generations per year varies according to species and latitude. In the Southern States of the Union these species seem to supply one generation after another uninterruptedly from March to the middle of November, that is, till the onset of severe cold. The life cycle of one generation during the summer takes about 4 weeks ; 7 days in the egg stage, 17 days in the larval stage, and 4 days in the pupal stage. The space of time between egg and adult insect, however, varies according to environment, and above all temperature, being shorter in proportion as the latter is greater. In South Carolina there are probably 5 or 6 generations annually for all the above species except *S. pictipes*, which normally has 3. In Illinois there are only 3 or 4 generations of *S. venustum*.

The larvae of *Simulium* are frequently parasitised by Nematode worms of the genus *Mermis* and also *Myxosporidia* ; they are also attacked by species of *Hydropsyche*. The pupae are not known to suffer from these parasites. The adult insect is often attacked by *Mermis*, and several writers have described other enemies of this insect is different countries.

Whether or not the buffalo gnat is a transmitting agent of disease is still a moot question. There is a serious difficulty in the way of solving this problem by experiment, as the adult insect refuses to engorge while in captivity. Therefore all that remains is to dissect the captured insect. " If it could be proved that a *Simulium* which has once engorged blood and oviposited is still in a condition favourable to a second oviposition, that is,

if rudimentary eggs are present in the ovaries awaiting only a second blood meal for successful development, then there would be a more definite basis for a theory of disease transmission by these insects." The Author used this method, and he discusses the results, which prove the following facts:

1) In all adults taken while ovipositing apparently digested blood was found in the stomach.

2) No eggs within the ovaries developed to the fullest degree without engorgement and the requisite time in which to digest the blood meal.

3) There appears to be strong evidence that after ovipositing (which leaves a few fully developed eggs in the ovaries and the remainder in a rudimentary condition apparently awaiting the necessary factors for development), adults feed again and continue to develop their eggs. The females alone are found engorging on blood, which indicates that they have acquired this habit for a special purpose.

Appended to the study is a bibliography numbering 227 works.

611 - **An Experimental Study of Pellagra in Mississippi, United States.** — *Scientific American*, Vol. CXIV, No. 4, p. 95. New York, January 22, 1916.

Doctors GOLDBERGER and WHEELER, of the U. S. Public Health Service, have just reported the results of a most interesting experimental investigation of pellagra, carried out at the farm of the Mississippi State Penitentiary. A volunteer squad of 12 white male convicts from 24 to 50 years of age was organised, and these men submitted themselves to experiment, under the incentive of an offer of pardon from the Governor, together with assurance of proper care and treatment if needed. There was no history of the occurrence of pellagra on the farm, and from the beginning of the experiment the squad was strictly segregated and placed under guard day and night. One man was disqualified in the course of the experiment. The rest remained under observation from the beginning of February to the end of October, 1915. Until April 19th they were kept on the ordinary prison diet, and no evidence of pellagra was detected. Thereafter they were kept on a restricted, one-sided, mainly carbohydrate (cereal) diet. Of the 11 volunteers, no less than six developed symptoms, including a "typical" dermatitis, justifying a diagnosis of pellagra. No other person on the farm presented evidence justifying even a suspicion of the disease.

612 - **Brewer's Yeast as a Source of Vitamines.** — *Scientic American*, Vol. CXIV, N. 13, p. 324. New York, March 25, 1916.

A recent report by Mr. ATHERTON SEIDELL, of the Hygienic Laboratory U. S. Public Health Service, describes a successful process of obtaining a cheap and stable vitamine in concentrated form, for use in treating nutritional deficiency diseases, such as beriberi, pellagra, etc. The preparation is obtained from brewers' yeast, which is pressed, autolysed by keeping at a temperature of about 100 deg. F. for 48 hours, and filtered through paper, the filtrate then being treated with LLOYD'S colloidal hydrous aluminium silicate reagent. Finally a solid residue is obtained by siphoning, desiccation, etc. The preparation has been given to pigeons in dose of 0.05 gram on alternate days, and the pigeons were thus enabled to retain normal

health and weight on an exclusive diet of polished rice, which would otherwise produce fatal polyneuritis. Completely paralysed pigeons have also been promptly cured by this new remedial agent.

AGRICULTURAL INSTITUTIONS

613 – **The Bureau of Applied Botany attached to the Scientific Committee of the Russian Ministry of Agriculture and its first 20 years of Work (1894–1914).** — REGHEL R., in « *Труды Бюро по прикладной Ботаникѣ* » (Bulletin of Applied Botany), Year VIII, No. 4-5 (79), pp. 327-658. Petrograd, 1915.

This Bureau, created in 1894, was intended to have three departments : 1) Scientific research ; 2) Acclimatisation ; 3) Information. It was at first called upon to study the cultivated and wild plants, noxious plants and weeds of the Russian Empire ; but from 1907 onwards this programme was cut down. A special Bureau of Mycology and Plant Diseases was created ; the study of ornamental plants was placed in the hands of the Imperial Botanical Garden of Peter the Great in Petrograd, and that of forest plants in those of the institutions under the Forestry Department. At the present time the sphere of action of the Bureau extends to the following plants ; 1) Cereals (wheat, barley, oats, rye, millet, sorghum, rice, etc.) (1); 2) Industrial plants (textile and oil plants, etc.) and other agricultural plants ; 3) Market garden, medicinal and aromatic plants, etc. Finally, the Bureau studies the natural flora, on the one hand noxious plants and weeds, and on the other hand meadow plants, especially grasses, sedges and pulses.

The Bureau did not begin operations in a regular way until 1907. The staff now consists of the director, a sub-director and 5 assistants, the work being distributed so that each is in charge of a given department.

The subjects studied include wheat, oats, weeds, comparative morphology of meadow grasses and sedges. As regards cultivated plants, the work chiefly relates to obtaining and fixing the different races of plants which are of practical importance to a given region. For these investigations the Bureau secures seeds from all parts of the Empire, either through its correspondents, or from farmers direct, reproducing them and carrying on selection work in the fields of its different sections. The latter at present number 4, of which 2 own their lands, which were given by the State, namely : the section of Voronej (264.40 acres) ; and that of Novgorod (449.5 acres) ; they also have experimental fields in other adjoining provinces, and some similar fields in the Caucasus and Turkestan. The location for each section and field is selected so as to present the conditions of the 3 principal typical natural regions of the Russian Empire, namely: forest, steppe, and semi-desert.

As regards the organisation of the work of the Bureau of applied Botany, an idea of it may be gathered from the method adopted by it for cereals, which is as follows : The entire crop originating from the seed distributed to the sections and to each experimental field of the Bureau is forwarded in the ear, to the Bureau at Petrograd, where it is examined by specialists. In order to study this material, the ears are sorted out according to varieties

(1) The Bureau does not deal with maize in particular, the latter being the subject of special study at the Agronomic Station of Ekaterinoslav.

and the hereditary differences between the different forms of a given variety are determined. On the basis of the results of these first enquiries, the different races are isolated and are studied as follows : On the one hand the isolated races are multiplied in pure lines (originating from an ear or a panicle), and their special biological features ascertained, together with their economic importance in agriculture if possible ; on the other hand, on the basis of the material gathered, there is determined the geographical distribution of the different varieties, and afterwards that of the races isolated from the mixed local forms. The determination of geographical distribution and the number of different races in the mixed, local forms is of great practical importance, as it clearly establishes the adaptability exhibited by these different races in the course of the struggle for existence under the local conditions of the different regions.

In the course of the investigations of the races of a given species, observations on mixed forms are gradually reduced, and chief attention is directed to the pure lines of the different races. The races fixed by the Bureau not being found on the market generally, the Bureau has organised the production of pure lines of the most interesting cereals, in sufficient bulk to allow of supplying them in small quantities for comparative tests.

At present the Bureau possesses 10 special collections, namely :

1) Wheats (4 100 samples ; 585 pure lines).
2) Barleys (2 932 samples ; 677 pure lines).
3) Oats (1 091 samples ; 98 pure lines).
4) Ryes (385 samples).
5) Millet, Sorghum, Rice, Maize (250 samples).
6) Industrial plants (844 samples, including 454 of sunflower).
7) Leguminosae (221 samples).
8) Meadow plants (490 samples).
9) Weeds (seeds of 520 species) ; subterraneans parts of 30 species ; 500 samples of weed oats).
10) General seed collection (1 699 samples of seeds, chiefly ornamental plants).

Furthermore, the Bureau has since 1908 published a monthly Review entitled : « Труды Бюро по прикладной Ботаникѣ » (Bulletin of Applied Botany) which, since the Plant-breeding Congress held at Petrograd in 1912, has been recognised as the central scientific organ for the work of plant selection in Russia. This periodical contains not only original Russian work, but also summaries of Russian and foreign work on the subjects which are within the scope of the Bureau. The original articles are summarised in French, English or Latin. Furthermore, this periodical often publishes, in an appendix, translations of the most important works published abroad, which may afterwards be collected into separate volumes. Finally the Bureau also publishes propaganda pamphlets on the subjects within its competency.

## CROPS AND CULTIVATION.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

614 – **The Presence of a Wet-repelling Film on the Surface of Particles of Sand and Mould.** — DEVAUX, H., in *Comptes Rendus de l'Académie des Sciences*, Vol. 162, No. 5, pp. 197-199. Paris, January 31, 1916.

On scattering a little dry sand on any water surface it is observed that most of the grains float. The usual proportion found by the Author with a sand of 0.37 mm. to 0.63 mm. diameter of grain was 60 to 63 %. A curious fact is that when the sand is very slightly moist (0.5 %), it still floats, better even than when dry in many cases, the proportion going up to 90 %. As soon, however, as the percentage of water reaches 1 %, all the grains immediately sink, not a single one floating. Therefore important changes must take place in the relations of the water to the sand, according as the latter is dry or moist to any degree.

Direct examination of the floating grains shows them to be incompletely wetted ; a small area of surface remains dry, even after the lapse of several days.

It was found tha :

1) After calcining, all the grains sink at once, retaining this sinking quality for several days.

2) When grains of sand are dropped on to a thoroughly clean water surface over which a thin film of an inert powder (talc) has been spread, each grain of sand in falling displaces the talc grains violently, which is a sure sign that a foreign substance with low surface tension is yielded up by the sand at the surface of the water. This substance is still given off by sand with 0.5 % of water and also sand with 1 % or more. In the latter case the quantity of substance given off is greater than with dry or nearly dry sand. The latter result is of particular interest because, in the case of moist sand, all the grains thrown on the water sink at once. This sinking is accompanied by a divesting process ; the moist sand may be regarded as surrounded by two concentric layers, one of water lying immediately against it, and the other of low tension impurities. This latter is an organic coating destroyed by calcination and displaced mechanically by the water in the second case .

These facts are not confined to pure sand ; they are also exhibited by soil to a much more pronounced degree even, in the finer portions. They are at their maximum in humus, and at their minimum in clay. The almost universal presence of a wet-resistant coating on the particles of the majority of soils is therefore a demonstrated fact. Necessarily, it reacts on the capillary properties of the soil.

615 – **The Movement of Soluble Salts with the Soil Moisture, Experiments at Utah, United States.** — HARRIS F. S., in *Utah Agricultural College Experiment Station, Bulletin* No. 139, pp. 119-124, 3 tables, 2 diagrams. Logan, Utah, 1915.

In the irrigated districts of the arid regions in the United States, where excessive quantities of water are used, there is usually an accumulation of

alkaline salts in the soils of the lower lands, in such quantities as to prohibit the growth of crops.

With the object of reclaiming these soils by drainage, it is important first of all to determine the rate of movement of injurious salts with water through the soil. To clear up this question the Author carried out a number of experiments to ascertain the movement of salts : 1) horizontally ; 2) upward ; 3) downward.

1) *Horizontal movement of salts.* — Special tanks were arranged, made of galvanised iron, 6 feet long, 1 foot wide and 4 inches deep. Soil (or other substance) was placed in the tanks to a depth of 3 inches, and, during the six months' period of experiment, 10 litres of tap water entering at one end were passed through the soil in each tank. The first 5 square feet of this soil were covered with paraffined paper to prevent evaporation, one square foot being left open at the end opposite to the water inlet for free evaporation of the water. The different substances used in the experiment were :

1) Greenville loam
2) Greenville loam + 1 % NaCl
3) Greenville loam + 2 % NaCl
4) Sand
5) Clay
6) Muck
7) Manure

At the end of the experiment the soil etc. was removed from the tanks in foot sections and the samples numbered 1 to 6, starting from the water inlet. The quantity of soluble salts remaining in each section was then determined. By averaging the quantity in each section of the different substances, the figures of Table I were obtained.

TABLE I. — *Average quantity of soluble salts remaining in each section of soil through which* 10 *litres of water had passed horizontally in* 6 *months* (*in parts per million of the dry substance*).

| Section No. 1 | Section No. 2 | Section No. 3 | Section No. 4 | Section No. 5 | Section No. 6 |
|---|---|---|---|---|---|
| 1 986 | 1 782 | 2 773 | 3 574 | 7 110 | 39 830 |

2) *Upward movement of salts.* — Evaporating cans of the STEVENSON and SCHAUB model were used, 11 inches in diameter and 13 inches deep, with a water supply tube at the bottom. Into 9 of these cans 10 kilogrammas of Greenville loam were placed, containing : 0, 1, 2, 3, 4, 5, 6 and 7 % respectively of sodium chloride. The soil was all made up to the same moisture percentage, and water added through the tube in the bottom twice a week to keep the weight constant. After 37 days the soil was removed in 6 sections of 1 inch each, and the total of soluble salts remaining in each sample determined. By taking the average of the respective quantities found in each section of the 9 cans, the figures of Table II were obtained.

TABLE II. — *Average of soluble salts in various depths after water had evaporated from soil for 37 days (in parts per million of the dry soil).*

| Depth of each Section | Quantity of salt remaining |
|---|---|
| 0 - 1 *inch* (0 — 2.54 cm.) | 129 587 |
| 1 - 2 *inches* (2.54 — 5.08 cm.) | 37 554 |
| 2 - 3 *inches* (5.08 — 7.62 cm.) | 20 649 |
| 3 - 4 *inches* (7.62 — 10.16 cm.) | 11 910 |
| 4 - 5 *inches* (10.16 — 12.7 cm.) | 10 003 |
| 5 - 6 *inches* (12.7 — 15.24 cm.) | 9 552 |

In all the cans there was a decided upward movement of salts and an accumulation at the surface, to the point of crystallisation. This was especially pronounced in the soils containing a large amount of salt. This experiment shows that the salts readily move upward with the water current and illustrates the method of alkali accumulation on the surface of irrigated lands.

3) *Leaching of Soils.* 5 glass percolators of the Oldberg type were filled with Greenville loam and arranged on a rack one above another so that water dripping from the top one percolated into the one below, and so on to the bottom. Above the top percolator was an inverted water bottle kept filled with water. A bottle was placed below the bottom percolator to catch all the water that passed through it. When one bottle was filled with the drainage water another was put in its place.

For 3 months water was constantly passed through the arrangement of percolators, fifty litres in all. The drainage water was caught up in 16 bottles, each holding about 3 litres, and the soluble salts determined in each bottle separately.

The first leaching contained 651 parts per million of solids. After this the salts dropped down to about 200 parts per million, and remained fairly constant during the rest of the experiment, falling finally to 172 per million in the 16th leaching.

The soil was allowed to remain in the percolators 6 months after the leaching had been discontinued. The nitrates and soluble salts were then determined in the soil of each percolator. The numbers found were comparatively uniform, ranging between 512 and 599 parts per million for the soluble salts, and 106 and 125 per million for the nitrates.

These various experiments, as a whole, show that salts are transferred through the soil very readily by moving water.

616 – **The Alkaline Reaction Produced by Acids in Soils, Viewed from the Standpoint of Plant Nutrition** (1). — MASONI GIULIO (Laboratory of Agricultural Chemistry of the Royal University of Pisa), in *Le Stazioni sperimentali agrarie italiane*, Vol. XLIX, Part 2, pp. 132-149. Modena, 1916.

In previous work (*Le Stazioni sperimentali agrarie italiane*, Vol. XLVI, 1913, p. 241 and Vol. XLVII, 1914, p. 674), comprising experiments with several acids and inorganic salts on chalky soils, it was found that citric acid in a comparatively high proportion and tartaric and malic acid in relatively smaller proportions (and also their acid salts) are alone, in spite of the alkaline reaction they cause, capable of retaining iron in solution, which is not the case when other, though possibly stronger, acids are used ; this phenomenon is related to the well-known property of oxyacids of combining the metal in special complex ions. A relation is thought to exist between the above phenomena and the chlorosis of limestone. Chlorosis in limestone soils, or, in a wider sense, the absorption of iron by plants in these soils, is thought to be connected with the nature of root secretions, absorption being impeded for those plants in particular the root secretions of which contain too little or none of the acid substances which, though they bring about the formation of OH in excess, allow iron to be present in solution, as is the case with citric, malic and tartaric acids and their salts.

This hypothesis is confirmed, inter alia, by the experiments of MAZÉ, ROUX and LEMOIGNE, in which the addition of very small quantities of tartaric acid and Rochelle salt, or citric acid and sodium citrate, proved particularly effective in causing the return of a green colour in chloritic plants grown in nutritive solutions containing iron and mixed with carbonate of lime.

Similar experiments were then made with compounds of manganese using : 1) common soils ; 2) mixtures of pure calcium carbonate with different compounds of manganese (manganous oxide, mangano-manganic oxide, manganese dioxide, manganese carbonate, manganese sulphate) ; 3) a mixture of common soils with manganese sulphate or dioxide. The action of the following acids, used almost always in decinormal solution, was tested : *mineral* : hydrochloric, nitric, sulphuric, and phosphoric ; *organic* : formic, acetic, oxalic, succinic, malic, tartaric and citric. From 25 to 50 grams of earth or mixture were treated with 50 to 100 cc of the acid solution ; the whole was shaken up several times, and some time later (mostly 8 hours, but always after the liquids had shown the alkaline reaction), it was filtered and the filtered liquid examined for manganese.

1) The experiments with soil prove that among the different acids tried, oxyacids alone retain manganese in solution in large proportions, notwithstanding the occurrence of the alkaline reaction due to them. Citric acid and malic acid proved particularly active ; tartaric acid on the other hand showed very favourable activity, which may possibly be connected with the greater insolubility generally presented by metallic tartrates in the presence of the corresponding citrates.

2) The trials made with pure calcium carbonate and with oxides of

(1) See also *B.* July 913, No. 778. (*Ed.*).

manganese demonstrated the decisive influence of the lime in the phenomena studied. The oxide of manganese behaved rather differently from the other oxides, giving a comparatively strong manganese reaction in the filtered liquid, even with acids other than oxyacids.

With manganese carbonate, much smaller quantities of manganese were obtained in solution, even under the action of oxyacids. These facts are explained by the remarkable facility of hydrolysis presented by manganese compounds, in solutions either dilute or of medium concentration.

The tests with manganese sulphate and calcium carbonate were conducted with quantities of salt corresponding to 2, 5 and 50 milligrams of manganese (in aqueous solution) to 15 grams of calcium carbonate; the solution of manganese sulphate and of calcium carbonate were left in contact for 12 hours before adding the acids; the filtered liquid was tested after 6 hours, and also after 24, 36 and 48 hours in the tests with 2, 5 and 50 mgms. of manganese. With the smallest quantity of manganese, whatever the acid used, relatively large quantities of manganese passed into solution 8 hours from the beginning of acid action, but these quantities were larger with citric and malic acid. On the filter a compound of manganese insoluble in water remained. 24 hours after the start of acid action no manganese remained in solution except in the test samples with citric and malic acid, not with the other acids. In the tests with 5 and 50 mgms. of manganese, a strong manganese reaction was found in all liquids, even after 36 and 48 hours, the explanation of which would be that some quantity of manganese sulphate remained in solution unchanged. Perhaps in this case likewise phenomena of hydrolysis became active during the prolonged contact between calcium carbonate and manganese sulphate, leading to the formation of manganese carbonate or oxides of manganese of different compositions, on which the acids successively produced the special action observed.

3) Experiments with manganese sulphate and dioxide mixed with earth proved: *a*) that for small quantities of sulphate (2 mgms. of manganese to 50 mgms. of earth), the treatment with citric and malic acids alone increased the quantity of manganese passing into solution, while for relatively large quantities (50 mgms. of manganese to 50 gms. of earth), the increase in dissolved manganese was marked on treatment with any acid; *b*) that, for dioxide, there was no increase of the manganese dissolved except on treatment with citric and malic acids.

The difference between these results and those of the preceding series may be explained by the far greater facility with which phenomena of hydrolysis take place in a soil, and the special action of the mass of soil on the adsorption of small quantities of products in solution.

It follows that the compounds of manganese naturally contained in the soil behave in a similar way to iron compounds as regards their solubility in acids, when lime is in excess, and the markedly greater capacity of oxyacids for retaining these elements in solution, in spite of the excess of OH occasioned by the acids themselves, is therefore likewise confirmed with regard to the manganese in the soil.

617 - **Experiments on the Growth of *Azotobacter*.** — CAUDA A., in *Le Stazioni sperimentali agrarie italiane*, Vol. XLIX, Part 2, pp. 125-131. Modena, 1916.

These experimental investigations were made at the Institute of Hygiene of the University of Turin during the 5 past years, under various conditions of environment. They prove the following :

*Action of Phosphoric Acid Salts.* These salts promote the growth of *Azotobacter*. Monocalcic and bicalcic phosphate are affected, tricalcic phosphate less so. The phosphates of potassium are more favourable to the development of *Azotobacter* than those of calcium, when steps are taken to secure the distribution of an equal quantity of phosphoric anhydride.

*Action of Nitrogenous Compounds.* The presence of these in a high proportion prevents fermentation of impure cultures and the formation of the typical film. In liquids containing 5 % of asparagine in a purified culture no films formed. Low percentage of nitrogen restores vegetative activity of *Azotobacter* on a solid medium (for instance nitrogen free agar).

*Action of Calcium Carbonate.* Its presence both hastens and prolongs fermentation, while in its absence the film forms with difficulty. The concurrent action of phosphoric acid and calcium carbonate yields excellent results.

*Action of Compounds of Magnesium* (dose 1 ‰). In the presence of sulphate of magnesium, and magnesium and sodium phosphate, fermentation begins sooner than in the presence of magnesium oxide. Magnesium chloride, showed no marked positive action.

*Influence of Humus.* *Azotobacter* develops more vigorously on agar-humus ; when after repeated transfers the organism struggles to maintain itself on Gerlach agar, it nevertheless resumes active vegetation if placed again on agar-humus.

*Azotobacter in Different Soils.* All soils do not possess the same fermentative power and the same capacity for producing the film, as is shown by the following table.

| | Fermentation |
|---|---|
| Rice-field ditch soil | Weak |
| Permanent rice-field soil | Good |
| Rice-field soil under rotation crops — upper part | Good |
| Rice-field soil under rotation crops — deeper part | Very weak |
| Irrigated meadow soil | Good |
| Compost | Very active |
| Tilled stubble soil | Very active |
| Nursery soil | Active |
| Chalky vine soil — cultivation layer | Very weak |
| Chalky vine soil — subsoil | Nil |

It has been found that in calcareous vine soil the form *Sarcina* preponderates.

*Growth in Association.* On agar, *Azotobacter* multiplies better in the presence of *Streptothrix* (chiefly *S. alba* and *S. odorifera*) than alone. A better growth is also obtained by combining the typical *Azotobacter* with the

blastomycetic form ; in the presence of the latter the spread of the black patch formed by the colonies is more complete and more rapid.

The best tilled soils, well ventilated, provided with humus and manured with mineral fertilisers, are those in which the growth of *Azotobacter* is most active, and the fixation of nitrogen in them is considerable. The vital conditions of this micro-organism therefore are a fresh proof of the efficiency of rational methods of practical agriculture.

618 – **Sterilisation of the Soil by Dry Heat.** — See No. 677 of this *Bulletin*.

619 – **Texture of the Soil in Java, Determined by Mohr's Method of Mechanical Analysis.** — VAN HARREVELD-LAKO C. H., in *Mededeelingen van het Proefstation voor de Java Suikerindustrie, Archief vor de Suikerindustrie in Nederlandsch Indië*, Year XXIV, Part 3. Soerabaja, January 1916.

A description is here given of MOHR'S method of mechanical analysis which differs from ATTERBERG'S method in that it sorts out the particles more gradually, and is more suitable for earths of volcanic origin.

MOHR separates the particles of the soil by centrifugalising a specimen to which water and a few drops of ammonia have been added. A jet of water under high pressure is made to play on the residue to disintegrate the particles, which are then again subjected to centrifugal action. By treating the successive residues in this way, particles of the following dimensions are separated from it :

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| from | 2 | to | 1 | mm | from | 0.05 | to | 0.02 | mm |
| » | 1 | to | 0.5 | » | » | 0.02 | to | 0.005 | » |
| » | 0.5 | to | 0.25 | » | » | 0.005 | to | 0.002 | » |
| » | 0.25 | to | 0.1 | » | » | 0.002 | to | 0.0005 | » |
| » | 0.1 | to | 0.05 | » | less than | | | 0.0005 | » |

The analysis of a few Javanese soils on this method proved the following :

Soils in which particles of 0.5 to 0.05 mm predominate allow rain and irrigation water to filter through rapidly and require plentiful irrigation for sugar-cane growing. They also need dressing repeatedly with sulphate of ammonia in small quantities.

The texture of the soils in which particles ranging from 0.05 to 0.02 mm predominate is very favourable to sugar cane cultivation. They are sufficiently absorptive and at the same time readily allow the excess of moisture to flow off.

The soils containing chiefly particles ranging from 0.02 to 0.002 mm. are less favourable in texture for sugar-cane growing.

MANURES AND MANURING

620 – **Injurious Effect of Farmyard Manure on the Balance of Nitrogen in the Soil.** — SABACHNIKOV A., in *Сельское Хозяйство и Лѣсоводство* (Agriculture and Sylviculture), Year LXXVI, Vol. CCL, pp. 5-19. Petrograd, January 1916.

A retrospective study of this important problem, based on the results of laboratory and field experiments conducted by different Russian and foreign investigators during the last 25 years led to the following conclusions :

1) The chief influence of farmyard manure on the balance of nitrogen in the soils must be attributed to the organic matters it contains and not to micro-organisms, which are of secondary importance.

2) The organic matter in the manure (especially undecomposed straw) being a good source of carbon for the soil micro-organisms, contributes : *a*) in an aerobic environment to the assimilation of nitrates, ammonia, amides and gaseous nitrogen and their deposition in proteid form ; *b*) in an anaerobic environment, in the presence of nitrate, to the assimilation of the latter ; and also on the other hand to its denitrification.

3) The nitrogen in farmyard manure is chiefly in an organic form, and its loss in the gaseous state is possible without its passing into the nitric state, both in an aerobic and anaerobic environment.

4) The organic matter, contributing to the conversion of the proteid nitrogen, indirectly promotes the loss of nitrogen in further decomposition.

5) A local retardation (in furrows, etc.) of the nitrifying processes is also possible owing to the organic matter, to the presence of which the nitrifying organisms are known to be very sensitive.

6) As to the question whether farmyard manure supplied to the soil in ordinary quantities (up to 28 tons par acre) reduces nitrification or not, the reply is that a negative conclusion cannot be drawn.

7) To the question whether farmyard manure has any influence on the loss of nitrogen in the soil, the answer may be partly *yes* and partly *no*, the nitrogenous condition of soil not dressed with farmyard manure being unknown. Possibly the presence of vegetable residues in the soil and the continuous conversion of nitrogen from the soluble form into the organic form or vice-versa may cause such heavy losses of nitrogen (although compensated by its assimilation from the air) that the effect of the additional organic matter in the form of farmyard manure is relatively unimportant. Furthermore, farmyard manure, from this point of view, is a substance which occasions both a gain and a loss of nitrogen.

621 - **On the Capacity of White Mustard to Fix Nitrogen and Enrich the Soil.** — PFEIFFER, in *Fühlings Landwirtschaftliche Zeitung*, Year 64, No. 21-22, pp. 521-534. Stuttgart, November 1-15, 1915.

Some years ago, Professor Hiltner stated that white mustard can enrich the soil in nitrogen. With a view to verifying this statement an experimental answer was sought to the following questions :

1) If a cereal and white mustard are sown together and the mustard is killed before flowering time (with sulphate of iron), is the cereal able to benefit by the fertilising elements fixed by the mustard, so as to furnish a larger yield than the cereal sown alone ?

2) What are the nitrifying powers of the soil in the cases when a cereal and mustard together, and a cereal alone, are grown respectively ?

The experiments were made in 12 pots, 30 cms. high, 36 to 37 cms. in diameter and 0.1 sq. metre in clear section, each containing a mixture of clayey-silicious earth and sand, to which a basal manure, consisting of 13 gms of monocalcic phosphate, 4 gms of sulphate of magnesia, 16.6 gms of sulphate of potash and 10 gms of calcium carbonate, was added.

After the first period of growth, nitrogen was given to the plants in the form of sulphate of ammonia, namely : 0.1 grm per pot on the 27th April, and 0.5 on the 11th May.

In 9 pots oats and white mustard were sown together ; in 3 pots, oats only. When the mustard began to flower it was killed in 6 pots by means of sulphate of iron. In 3 pots of this set the mustard was left after the treatment with sulphate of iron, to serve as green manure ; in the other 3 pots it was removed. Again, in 3 pots the mustard was not killed and was allowed to grow until the oats were completely ripe.

*Results of the Experiment.* — The white mustard left on the earth of the pots not only did not increase the oat crop, but even reduced it to some small extent.

The analysis of the oat plants showed that they had not benefited by the nitrogen of the green manure formed by the mustard which had been allowed to remain.

The pots containing oats only, gave a yield much higher than that of pots containing oats and mustard together. The explanation is that the mustard utilised a portion of the nitrogen of the soil for its growth, at the expense of the oats.

With regard to nitrification, it was feebler in the pots containing oats + mustard than in those with oats alone, but the difference was very small, being $0.33 \pm 0.103$ mgms.

The experiment thus shows that, contrary to Hiltner's assertion, white mustard is not a source of nitrogen for the soil and plants cultivated therein.

622 - **Investigations into the Utilisation of Phosphorites in Russia.** — I. PRIANICHNIKOV, D. N. *On Experiments with Phosphorites in* 1914, in *Отчетъ объ опытахъ по химической переработкѣ фосфоритовъ и вегетаціонныхъ опытахъ съ ними, подъ редакціей проф. Д. Н. Прянишникова* (Experimental Studies on Phosphorites). Vol. V, pp. III-IX. Moscow, 1915. — II. KASAKOV, A. V. The Extraction of Phosphoric Acid from Natural Phosphates. (Influence exerted by the form of the agitator and the speed of rotation on the course of reaction). *Ibid.*, pp. 1-15. — III. KOBLIKOV, N. P., The Preparation of Superphosphates by means of Saratov and Perm Phosphorites. *Ibid.*, pp. 16-22. — IV. KOTCHETKOV, V. N., and KOBLIKOV, N. P. The Extraction of Phosphoric Acid from the Phosphorites of Wiatka. *Ibid.*, pp. 12-15. — V. CHVEZOV, K. N., Study of the Process of Precipitation, *Ibid.*, pp. 23-37. — VI. KASAKOV, A. V., The Action of Mineral Acids in small quantities on natural Phosphates of Lime. *Ibid.*, pp. 38-50. — VII. JAKUCHKIN, I. V., Phosphates in the Soils of the Experimental Stations of Southern Russia. *Ibid.*, pp. 51-65. — VIII. JAKUCHKIN, I. V., On the Assimilation of the Phosphoric Acid in some Phosphorites by Cereals. *Ibid.*, pp. 66-84. — IX. USPENSKIJ N., A., Wolter Phosphate. *Ibid*, pp. 85-100.

Vol. V of the works of the Agronomic Institute of Moscow for investigations of phosphorites contains the reports drawn up by Prof. PRIANICHNIKOV, on the investigations in 1914 relating to : 1) chemical preparation of phosphorites ; 2) field tests on crops with these phosphorites. The experiments bore partly on the possibility of increasing the number of phosphorites susceptible of direct conversion into superphosphates, and partly on the improvement of the methods of extraction of phosphoric acid for the preparation of concentrated phosphate manures ; with this view the conditions

of precipitation of phosphoric acid from the solution were also studied. In the crop tests the action of bicalcic phosphate and some phosphorites was studied.

The following is a brief summary of the results of the most important of these experiments presenting any general interest :

A. — EXTRACTION OF PHOSPHORIC ACID FROM PHOSPHORITES. — From the experiments made during the preceding years by M. KASAKOV in the laboratory of Prof. PRIANICHNIKOV, it was found that by steeping the phosphorites in a given quantity of water and afterwards treating the mixture with sulphuric acid, almost the whole of the phosphoric acid contained in them may be extracted, a result unobtainable by other methods. The experiments of KASAKOV and Messrs. KOTCHETKOV and KOBLIKOV, carried out in 1914, complete the study of the subject.

I. KASAKOV'S experiments were directed to determining the influence exerted by the shape and speed of rotation of the agitator on the reaction taking place in the mass of phosphorite powder and sulphuric acid. Trials were made with different types of agitators, that of GATTERMAN giving the best results.

In the experiments with phosphoric powder of Viatka, the degree of concentration of the sulphuric acid was varied (from 10 to 50 %) and also the speed of rotation of the agitator (300 to 1800 revolutions per minute). The results of these experiments may be summarised as follows :

1) The quantity of froth (undesirable for many reasons) formed in the decomposition of the phosphorites owing to the evolution of gas (especially $CO_2$) diminishes as the speed of rotation of the agitator is increased.

2) At a given speed of rotation froth ceases to form, and the reaction then reaches its maximum energy. This speed, which may be called the optimum, depends on the dimensions of the agitator and the vessel, the quantity and quality of the mass, degree of concentration, etc., but varies within very narrow limits, which remain constant, all other conditions being equal. By observing the surface of the mass and correspondingly altering the speed of rotation of the agitator, the *optimum* speed may be secured in the most divergent conditions. Some practical methods for effecting this determination are also suggested.

3) With an insufficient speed of rotation of the agitator, the separation of phosphoric acid is incomplete ; it is also incomplete if sulphuric acid of 40 per cent strength and beyond is used. Thus, by using sulphuric acid of 10.19 per cent., 99 per cent of the total phosphoric acid was separated, while by employing sulphuric acid of 40 per cent, and afterwards 50 per cent strength, the yield of phosphoric acid dropped to 92.55 and 90.4 per cent. respectively of the total quantity.

4) In laboratory investigations of phosphorites it is essential to fix definitely the method employed for mixing the mass, as this has a marked influence on the behaviour of the reaction. On the other hand the result of the enquiries of KASAKOV furnish practical indications even for the industrial extraction of phosphoric acid from phosphorites.

II. In their experiments on the extraction of phosphoric acid from the

phosphorites of Viatka, Messrs. KOTCHETKOV and KOBLIKÔV studied the influence exerted on the process of extraction by : the quantity and concentration of the sulphuric acid, the steeping of the phosphorites in water the temperature, the duration of the treatment and of mixing. They arrived at the following results :

Alterations of the conditions under which the phosphoric acid is extracted have a marked influence on the proportion extracted, it being found possible, by suitable modifications, to bring up the amount of phosphoric acid passing into solution from 73.77 to 95.67 per cent. This result, which is the maximum, was secured by continually stirring up the mass during the entire period of reaction (10 minutes), after previously steeping the phosphorites in water and subsequently treating them with sulphuric acid at 30° C. (86° F.).

On the basis of these experimental results and those of previous years, it is stated that the problem of the complete extraction of phosphoric acid from any phosphorites by means of sulphuric acid is now effectively solved.

III. It being possible to manufacture precipitated phosphates instead of superphosphates in Russia, M. CHVEZOV has investigated precipitation by means of gypsum in different solutions of phosphoric acid, endeavouring to determine the influence of different factors. It was found that : 1) time directly influences the process of precipitation ; 2) with increase of the basic quantity the speed of reaction grows, but at the same time the total percentage of phosphoric acid and soluble phosphoric acid in the citrate of ammonia declines, as well as the quantity of undecomposed gypsum ; 3) the fineness of the base markedly affects the process. Among other results of these experiments mention must be made of that relating to the temperature of the solution : an increase of temperature of the solution for precipitation decreases the solubility of the precipitate in citrate of ammonia, and probably the degree of assimilation ; enquiries into this question are of interest, as they will bring to light the conditions for attaining highly assimilable precipitates.

IV. By enquiries into the action of the mineral acids in small quantities on natural phosphates, M. KASAKOV desired to ascertain whether, for obtaining bicalcic phosphate, a simpler method can be used instead of precipitation by lime water or gypsum, requiring a lesser quantity of acids than in the production of superphosphates and avoiding the use of lime.

The results as regards natural phosphates of lime (bones and phosphorites) are as follows :

On treating bones freed from grease and degelatinised (34 % $P_2 O_5$), it is found that aqueous solutions, dilute or concentrated, of phosphoric acid, and also of pure or commercial sulphuric acid, used in sufficient quantities, completely convert the phosphate of the bones into crystalline bicalcic phosphate ($Ca HPO_4 + 2 H_2O$). Treatment with phosphoric acid yields a product containing 38 to 39 % of that acid soluble in great part in PETERMANN'S reagent (up to 91 %). When the phosphates are treated with sulphuric acid (in small quantities), the result is the " semi-super-

phosphate" (a name denoting the technical product containing both bicalcic phosphate and gypsum) which has excellent physical properties and contains on the average 23 per cent. of total phosphoric acid, most of it (up to 90 %) soluble in PETERMANN'S reagent.

Nevertheless, negative results were obtained when the phosphates were treated with commercial phosphoric acid (a concentrated extract obtained from phosphorites by the aid of sulphuric acid); this failure is attributed to "inactivity" of the phosphoric acid, the reason and the conditions of occurrence of which will be studied subsequently.

B. CULTIVATION TRIALS WITH PHOSPHATES AND PHOSPHORITES. — I. The cultivation trials with phosphates, carried out by JAKUCHKIN, had for their object the comparison of the action of precipitated phosphate and superphosphate, the latter being regarded in southern Russia as the most perfect phosphate manure and impossible to surpass for black earths.

The soil for the cultivation tests was taken exclusively from the fields of the experimental stations in southern Russia; the plants were millet and sugar-beet, and the manures used were: 1) superphosphate with 15 % $P_2O_5$ prepared according to standard methods 2) 16 % basic slag, of Russian production; 3) Palmer's phosphate, considered to be the best precipitated phosphate (37.94 % $P_2O_5$); 4) precipitated phosphate from a Russian factory (40 % $P_2O_5$), the only bicalcic phosphate produced in Russia on an industrial scale. The results of the experiments, as regards comparison between the action of superphosphates and bicalcic phosphates on black earths, proved that the latter, if properly prepared, are equal in their action to superphosphates and sometimes even superior, as shown by the following table, which indicates the results given by Palmer's phosphate, taking the crop obtained by using superphosphate as equal to 100.

| Station of | Millet | Sugar-beet |
|---|---|---|
| Simbirsk | 103 | — |
| Tchimschinsk | 110 | — |
| Ekaterinoslav | 99 | — |
| Rostov | 116 | — |
| Mironovka | 133 | — |
| Svatovka | 96 | — |
| Konstantinograd | 98 | 95 |

II. The cultivation tests with phosphorites, also carried out by JAKUSCHKIN, are a continuation of the trials in which he had shown that there are phosphorites containing phosphoric acid in a form which can be assimilated by cereals. Taking as a basis the fact observed in previous years, that if 4 to 5 % of the total phosphoric acid in the phosphorites is soluble in PETERMANN'S reagent (alkaline citrate of ammonia), the cereals are able to utilise appreciable quantities of the phosphoric acid, the writer was able, among the many specimens which the Commission for the study of phosphates sends to the laboratory, to select those best adapted for his investigations, and he found that some phosphates of the province of Saratov are partly assimilable by cereals.

623 – **Chemical Composition of "Potassic Ash".** — WÜRTHEIM A. (Rijkslandbouwproefstation te Maastricht), in *Verslagen van Landbouwkundige Onderzoekingen der Rijkslandbouwproefstation*, No. XVIII, pp. 86-89. La Haye, 1915.

In the smelting of iron in blast furnaces, the gases which are given off deposit their solid particles in the form of a brown powder. This powder is utilised as manure under the name of "potassic ash", and its value depends on its contents of soluble potash. About 80 per cent of the total potash is soluble in water; the proportion of potash and of the other components, however, vary to such a degree that no average can be fixed. The analysis of samples gave the readings shown below:

*Composition of 3 Samples of Potassic Ash.*

| Components | Specimen N° 1 | Specimen N° 2 | Specimen N° 3 |
|---|---|---|---|
| Potash | 9.96 % | 10.38 % | 16.78 % |
| Soda | 5.54 | 5.82 | 6.63 |
| Iron | 3.73 | 26.86 | 4.70 |
| Alumina | 0.26 | 2.01 | 0.49 |
| Manganese | 8.21 | 2.98 | 2.71 |
| Magnesia | 5.39 | 3.11 | 1.07 |
| Lime | 16.87 | 7.69 | 12.14 |
| Silicates ($SiO_3$) | 30.74 | 15.41 | 20.80 |
| Chlorides (Cl) | 0.89 | 1.24 | 12.66 |
| Sulphates ($SO_4$) | 0.12 | 2.70 | 1.13 |
| Sulphides (S) | 1.49 | 0.61 | 1.23 |
| Carbonates ($CO_3$) | 4.91 | 2.86 | 4.53 |
| Cyanides (CN) | 0.21 | 0.10 | 0.21 |
| Sulphocyanides (CNS) | 0.30 | 0.12 | 0.83 |
| Phosphates ($PO_4$) | — | 0.24 | 0.23 |
| Moisture | 1.52 | 1.74 | 4.48 |
| Loss in calcination | 3.42 | 4.39 | 2.83 |

It should be noted that the high chlorine content of specimen No. 3 may be a difficulty as regards its use for manuring purposes, particularly with chlorophobe plants.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS

624 – **Edible Mushrooms of Hungary.** — BERNÁTSKY JENÖ, in *Erdeszeti Kiserletek*, Year XVIII, No. 3, pp. 81-113 + 6 photogravures. Selmecbánya, 1915.

Observations made in the course of the last 20 years have led the writer to conclude that edible mushrooms are abundant in Hungary, but their consumption is rather limited; firstly, because the consumers are excessively prudent or the sellers insufficiently informed; and secondly, owing to the

faulty, mistaken or contradictory particulars given in the literature of the subject with regard to certain edible mushrooms. With a view to dealing with these points, the writer decided to: 1) collect physiological and biological information in reference to the edible mushrooms of any economic importance of the different parts of the country; 2) to make a statement on certain general considerations with regard to different species, edible, poisonous, or indifferent; 3) to give clues for determining the species greatly resembling each other; 4) furnish practical advice on the gathering and utilisation of mushrooms. The article is followed by an alphabetical list of the scientific names and the common Hungarian names.

The following is the list of edible mushrooms:

*Lactarius piperatus* Fr.
*L. chrysorrhoeus* Fr. (= *L. zonarius* B.)
*Amanita rubescens* Pers. (= *Agaricus rubens* Scop., or *A. pustulatus* Schaeff.).
*Lepiota procera* Scop.
*Armillaria robusta* A. et S.
*A. imperialis* Fr.
*Russula virescens* Schaeff.
*R. heterophylla* Fr.
*R. vesca* Fr.
*R. cyanoxantha* Schaeff.
*R. alutacea* Fr.
*R. integra* L.
*R. aurata* Fr.
*R. delica* Fr.
*Pleurotus ostreatus* Jcq.
*Clitocybe infundibuliformis* Schaeff.
*Clitocybe viridis* Scop.
*Boletus granulatus* L.
*B. rufus* Schaeff (= *B. versipellis* Fr., or *B. aurantiacus* Bull.)
*B. scaber* Bull.
*B. badius* Fr.
*B. regius* Krombh.
*B. luteus* L.
*B. flavus* With.
*Coprinus comatus* Mull.
*C. atramentarius* Bull.
*Peziza acetabulum* L.
*P. aurantia* Fl. Dan.
*P. badia* Pers.
*Cratarellus cornucopioides* Pers.
*C. clavatus* Fr.
*Choiromyces meandriformis* Vitt.

625 – **Manganese in Wheat.** — HEADDEN W. P. (Chemist, Colorado Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. V, No. 8, pp. 349-355. Washington, D. C., 1915.

The presence of manganese has already been detected in different plant parts, and is even supposed to exist in all. Some writers maintain it to be an occasional constituent; others say that it plays an important physiological part as a catalytic agent. The writer ascertained the quantity of manganese in a series of specimens of wheat and other cereals, with the results given in the following Table.

*Conclusions.* — (1) Manganese seems to be present in wheat whatever its origin, independently of soil and climatic conditions.

(2) It is present in the wheat grain in the same proportion as iron, although the latter greatly predominates in the soil.

(3) Manuring does not increase the quantity of manganese in the grain.

(4) The amounts of water supplied to the cultivations (from 1 to 3 feet) did not affect the managanese content of the grain.

(5) Manganese being present in all the grains (and plants) investigated, in more or less equal quantities and under different conditions, it seems unlikely that it can be other than an an essential constituent.

Appended to the original is a list of 7 works consulted.

*Manganese Contents of different Wheats and other Cereals*
*(as percentage of air-dried material)*

| Cereals analysed | Manure or treatment | Origin | Manganese |
|---|---|---|---|
| *Wheat (grain)*: | | | |
| Varieties «Defiance», «Red Fife» and «Kubanka» | Nitrogenous manure | Colorado (U. States) | 0.004 – 0.005 % |
| » » » » | Phosphatic manure | » » | 0.004 – 0.005 |
| » » » » | Potassic manure | » » | 0.004 |
| » » » » | None | » » | 0.004 – 0.005 |
| » » » » | 1 year fallow | » » | 0.005 – 0.007 |
| «Marquis» variety . . . . . | Stable manure | Idaho (U. States) | 0.005 – 0.006 |
| » » . . . . . | None | » » | 0.005 – 0.006 |
| Different varieties . . . . . | — | U. States – Canada – Russia – Sweden – Holland. | 0.004 – 0.008 |
| Two-grain wheat (*Triticum dicoccum*) . . . . | — | Colorado (U. States) | 0.004 |
| *Other cereals (grain)*: | | | |
| Rye . . . . . | — | Colorado (U. States) | 0.004 |
| Naked barley . . . . . | — | » » | 0.002 |
| Oats . . . . . | — | » » | 0.005 |
| *Wheat (whole plants)*: | | | |
| Varieties «Defiance», «Red Fife» and «Kubanka» | Phosphatic manure | Colorado (U. States) | 0.002 – 0.004 |
| » » » » | Potassic manure | » » | 0.002 – 0.004 |

626 – **Investigations into Vegetable Oils: Results and Problems.** — IVANOV S. L. in *Сельское Хозяйство и Лѣсоводство* (Agriculture and Sylviculture), Year LXXV, Vol. CCXLIX, pp. 399-448. Petrograd, November 1915.

This paper embodies the results of researches into vegetable oils extending over a period of 7 years. Among the chief objects of the writer was that of demonstrating that the nature of these oils must vary according to the different classes of the vegetable kingdom. By studying the processes of their formation in different plants and ascertaining the features common to these processes it might be possible to discover principles enabling a " natural classification " of vegetable oils to be substituted for the present, artificial, one.

Systematic enquiries into botanic families have shown that kindred forms exhibit a resemblance in the process of formation of the oils, and identity in the reserve products. There are entire groups of plants which furnish perfectly similar oils and other products. On the other hand, different families produce oils containing different fatty acids.

The process of formation of the oils during ripening of the seed exhibits the common feature that the value of the iodine index enables the course of this process to be predicted. Oils with low iodine index are formed with all their characteristics in the seeds, at the very start of the process, while those with high iodine index form gradually, and the oils correspond-

ing to the first ripening stages of the seeds differ greatly from those of the more advanced stages.

From his study of oils in different plant species the writer has devised a theory which he calls that of " physiological characteristics ". Whereas the morphological characteristics tend to become modified and eventually to give rise to new species, the physiological characteristics are more independent of environment and tend to stability. The physiological characteristics may thus be regarded as themselves constituting a specific character and would occur in practically identical form in closely related species or at most very slightly modified by evolution. It is considered that this theory should lead not only to important deductions in botanical science but that it also holds out the prospect of building up systematic botany on the basis of vegetable physiology.

A list is given of new descriptions of oil suitable for food and industrial purposes ; among the latter are the oils of the Ranunculaceae, the pine and several wild mallow plants.

627 - **Influence of Hydrogen Peroxide on Germination.** — DEMOUSSY E., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 162, No. 12, pp. 435-438. Paris, March 20, 1916.

Seeds of garden cress, 7 years old, put into a little distilled water but not submerged, did not germinate at 27° C. (80.6° F.), a temperature highly favourable to the development of good seeds of the same species ; but in dilute hydrogen peroxide (0.6 volumes) germination begins on the 3rd day, and after 10 days includes about 30 % of the seeds tested. By further diluting the solution, the result is still better ; with a reagent of 0.25 vol., the germinating capacity approaches 40 %.

Preliminary steeping of the seeds, even for a long time, in hydrogen peroxide is insufficient ; germination only takes place in the presence of this reagent, and as it is rapidly destroyed on contact with the seed, losing $^{9}/_{10}$ ths. of its active oxygen within 24 hours, it requires daily renewal.

Does the $H_2 O_2$ act as a source of oxygen or as an antiseptic ?

The old seeds brought into contact with pure water at 27° C. (80.6° F.) are rapidly attacked by micro-organisms which multiply very fast. Nothing of the kind occurs in the hydrogen peroxide. Steeping in an antiseptic solution however does not produce the same effect.

At temperatures varying from 10° to 14° C. (50° to 57° F.) the results are no longer the same. Towards the 6th day germination began in all specimens ; after 15 days it averaged 25 % in the pure water and 45 % in the hydrogen peroxide diluted to 0.25 vol. In this way, seeds, of high germinating capacity in the cold, at 27° C. (80.6° F.) failed to germinate, though this temperature is very favourable to the young seeds, which, within 24 hours, show embryos 2 mm. in length, whereas at 12° (53.6° F.) these latter are hardly apparent.

On the other hand, at a low temperature, the micro-organisms develop very slowly, only appearing towards the 10th day after the beginning of germination. This observation supplies the explanation of the above phenomena.

In the old cress seeds, the germinating energy is greatly weakened, so that development is only manifest after a comparatively long time; seeds of low vitality have to contend with their parasites. There is a fight for oxygen, and which particular seeds will survive depends on the conditions.

At 27° (80°.6 F.) the micro-organisms develop rapidly (within less than 48 hours) and leave no oxygen over for the seeds, which require 4 days to germinate, germination is therefore impossible and the seeds rot. At a low temperature, the position is reversed because in this case development of the micro-organisms is several days behind germination.

When the seeds are placed in hydrogen peroxide the latter reagent hinders the growth of the micro-organisms, but not that of the seeds, so that germination can take place at any temperature. The $H_2 O_2$ at the same time acts as a source of oxygen; this results from its effect on the good cress seeds from the last crops; in the oven, the length of the embryos is perceptibly increased owing to its presence, so much so that their growth may be said to be a function of the inflow of oxygen; at a cold temperature, the processes of oxidation being less rapid, the hydrogen peroxide ceases to be of use, and, being slightly toxic, it may even retard germination slightly.

A last observation goes to bear out the accuracy of this interpretation. The old seeds above mentioned, which fail to germinate in pure water at 27° C. (80.6° F.), germinate at that same temperature to the extent of 25 % when placed in wet sand; the reason is that the aeration surface is then larger and the access of oxygen easier.

It follows that tests of germinating capacity carried out in propagating-pans may lead to the condemnation of seeds which, when placed in the ground, would prove of medium quality. This is a conclusion already arrived at in practice, particularly as regards beet seeds.

628 – **Fluorine in the Vegetable Kingdom.** — GAUTIER A. and CLAUSMANN P., in *Comptes rendus de l'Académie de Sciences*, Vol. 162, No. 3, pp. 105-112. Paris, January 17, 1916.

In previous publications the methods have been discussed by which the Authors have been able to make a quantitative determination of the fluorine present, even in traces, in minerals, water, and living tissues (1). Fluorine is found to exist in all animal tissues, but in very different proportions, and in two forms at least; in tissues cutaneous in their nature or relation, the life of which is obscure (the epidermis, the enamel of teeth, nails, body hair, scalp hair, etc.) the fluorine is abundant and may exceed 180 mgms. per 100 grms. of dry tissue. On the other hand, in tissues of high vitality, barely 1 to 4 mgms. of fluorine per 100 grms. of dry substance are found. Finally, in tissues of medium vitality (bones, tendons, cartilages, etc.), the fluorine shows an intermediate proportion.

In all cases fluorine is accompanied by phosphorus, and, though not proportional to this latter, increases or declines with it. While in tissue of intense vitality and rapid metabolism, however, only 1 to 4 parts of fluorine are found as compared with from 350 to 1500 parts of phosphorus,

(1) *Comptes rendus de l'Académie des Sciences*, vol. 154, 1912, pp. 1469, 1670, 1753, and *Bulletin de la Société chimique*, Series 4, vol. II, p. 875. (*Ed.*).

in tissues the life of which is more obscure, and which serve for mechanical protection or ornamentation, and are eliminated from the organism direct without change of form (epidermis, hair, nails, etc.) 1 part of fluorine is found to 3.5 parts only of phosphorus, these being the same proportions as found in mineral fluorophosphates such as apatites. In proportion, therefore, as the ultimate particles ("micellae") of tissue with highly specialised vital processes (muscles, glands, etc.) function and break down so the fluorine, initially occurring in highly complex forms in which its mode of combination with phosphorus could not be discerned, becomes gradually concentrated and increases in amount relatively to the latter element, until finally, in the dermal products (body and scalp hair, feathers, nails, etc.) which are ultimately detached or eliminated, the ratio $\frac{P}{F} = 3$ to 5, which is that of fluorophosphates, is reached, *i. e.* the fluorine has passed into the mineral form no longer utilisable by the animal system (1).

These observations, which summarise the results of the lengthy labour of investigation of the state of fluorine in animal tissues, led to the same studies being undertaken in plants. Do all the latter necessarily contain fluorine? Is that element fixed more particularly in any given organs of the plant? Do fluorine and phosphorus always occur together in the plant tissues and do they vary in the same direction? Are there any plants or plant families having special need of this element? These questions are partly answered by the researches herewith.

With a view to ascertaining the changes through which fluorine passes from plant to animal, the element was particularly sought in vegetables or parts of them used for the food of man and herbivorous animals: wheat, barley, oats, fruit, pulses, hay, straw, etc., and, by way of supplementing these: young leaves, wood, bark, etc., care being taken always to make a quantitative valuation of the phosphorus in the same specimens where this was done for fluorine.

The Table here appended indicated the percentages found. The fluorine and phosphorus are always given in milligrams in reference to 100 grams of vegetable tissue fresh or dried.

From these experimental data the following few conclusions may apparently be drawn:

The *leaves* are the organs richest in fluorine. From 3 to 14 mgms of this element are found in 100 gms of leaves calculated as dry; lucerne 5.65 mgms, sainfoin 7.25 mgms, sorrel 13.87 mgms, chicory 5.88 mgms, spinach 3 mgms, dandelion 8.20 mgms, beetrot 13.40 mgms, mustard 6.80 mgms. In these leaves the proportions of phosphorus are, generally speaking high relatively to the rest of the plant: lucerne 138 mgms, chicory 702 mgms,

(1) On this subject see the papers by the writer in: *Comptes rendus de l'Académie des Sciences*, vol. 156, 1913, pp. 1347 and 1425; vol. 157, 1913, p. 94. — *Bulletin de la Société Chimique*, Series 4, vol. 13, p. 905; vol. 15, p. 241. — *Bulletin de l'Académie de Médicine*, Series 3, vol. 71, p. 63. (*Ed.*).

*Comparative Table of the Quantities of Fluorine and Phosphorus in various Plants and their Products.*

| Nature of Product | Fluorine per 100 gms of fresh substance | Fluorine per 100 gms of dry substance | Phosphor. per 100 gms of dry substance | Ratio P / F | Remarks |
|---|---|---|---|---|---|
| | mgms | mgms | gmms | mgms | |
| *Gramineae:* | | | | | |
| Wheat (flour) . . . | 0.83 | 1.00 | 150 | 150 | Limestone soil of Champagne. |
| » (bran) . . . | 0.59 | 0.68 | 1 080 | 1 588 | |
| » (flour) . . . | 1.17 | 1.41 | 134 | 95 | Granitic soil of Brittany. |
| » (bran) . . . | 0.36 | 0.42 | 1 102 | 2 623 | |
| Other wheat flour. . | 0.71 | 0.86 | — | — | Limestone soil (Marne). |
| Rye (flour). . . . . | 0.52 | 0.61 | 176 | 288 | |
| Barley (flour). . . . | 2.0 | 2.20 | — | — | |
| Rice . . . . . | 0.80 | 0.94 | 101 | 107 | Not in husk. |
| *Leguminosae:* | | | | | |
| Haricots . . . . . | 1.70 | 2.18 | 530 | 252 | Soissons beans. |
| Lentils . . . . . | 1.56 | 1.80 | 500 | 277 | |
| French beans . . . | 0.019 | 0.21 | — | — | Edible pod. |
| Lucerne . . . . . | 1.30 | 5.65 | 318 | 56 | Stalks and leaves. |
| Sainfoin . . . . . | 2.72 | 7.25 | 167 | 23 | Stalks and leaves. |
| *Cruciferae:* | | | | | |
| White-headed cabb. . | 0.088 | 1.08 | — | — | Green cabbage. |
| Cauliflower . . . . | 0.21 | 2.57 | — | — | Cabbage head. |
| Turnip (roots) . . . | 0.14 | 2.02 | — | — | Paris turnip. |
| Radish (roots) . . . | 0.06 | 2.00 | 769 | 384 | Small red raddish. |
| Cress . . . . . | 0.093 | 1.34 | — | — | Leaves and stalks. |
| Long radish . . . . | 0.24 | 1.20 | 268 | 223 | |
| Mustard (seeds). . . | 1.45 | 1.58 | — | — | Black mustard. |
| » (leaves) . . | 0.76 | 6,80 | 383 | 56 | |
| *Diplotaxis* . . . . . | 0.010 | 0.059 | — | — | Whole plant. |
| *Rosaceae:* | | | | | |
| Pear (pulp) . . . . | 0.022 | 0.17 | — | — | "Passe-crassane" variety. |
| Apple (pulp) . . . . | 0.034 | 0.21 | 63 | 300 | |
| » (rind) . . . . | 0.76 | 2.78 | 83.7 | 30 | |
| Peach (flesh) . . . | 0.29 | 3.93 | 219 | 55 | |
| » (stone) . . . | 0.74 | 2.60 | — | — | |
| Apricot (flesh) . . | 0.30 | 2.50 | 157 | 62 | |
| Cherry . . . . . | 0.37 | 3.70 | 159 | 43 | Flesh and skin. |
| Strawberry . . . . | 0.12 | 140 | — | — | |
| *Solanaceae:* | | | | | |
| Potato (root) . . . | 0.084 | 0.30 | — | — | "Saucisse rouge" variety (Without skin). |
| Potato (flour) . . . | 0.158 | 0.18 | 80 | 444 | |
| Tomato (fruit) . . . | 0.20 | 4.06 | — | — | |
| *Polygonaceae:* | | | | | |
| Buckwheat (flour) | 2.17 | 2.53 | — | — | |
| Sorrel . . . . . | 0.98 | 1.387 | 621 | 45 | Leaves. |
| *Synanthereae:* | | | | | |
| Chicory . . . . . | 0.32 | 5.88 | 702 | 119 | Leaves. |
| Dandelion . . . . . | 0.97 | 8.20 | 464 | 56 | Leaves. |

*Comparative Table of the Quantities of Fluorine and Phosphorus in various Plants and their Products.* (continued)

| Nature of product | Fluorine per 100 gms of fresh substance | Fluorine per 100 gms of dry substance | Phosphor. per 100 gms of dry substance | Ratio P F. | Remarks |
|---|---|---|---|---|---|
| | mgms | mgms | mgms | mgms | |
| *Umbelliferae:* | | | | | |
| Carrots | 0.036 | 0.34 | — | — | Root. |
| *Liliaceae:* | | | | | |
| Asparagus | 0.52 | 7.94 | 736 | 93 | Young shoots or suckers. |
| *Chenopodiaceae:* | | | | | |
| Spinach | 0.37 | 3.00 | — | — | Young leaves. |
| Beetroot | 1.00 | 13.4 | 490 | 36.6 | Leaves. |
| *Malvaceae:* | | | | | |
| Cacao | 1.69 | 1.78 | 224 | 125 | Husked bean. |
| *Rubiaceae:* | | | | | |
| Green coffee | 1.20 | 1.45 | 327 | 225 | Unroasted berries (Martinique) |
| *Ampelidaceae:* | | | | | |
| Grape | 0.12 | 0.81 | — | — | Black grape (grape without stalk). |
| *Moraceae:* | | | | | |
| Fig | 0.27 | 1.98 | — | — | Fresh fig. |
| *Juglandaceae:* | | | | | |
| Walnut | 0.68 | 0.78 | — | — | Kernel. |
| *Musaceae:* | | | | | |
| Banana (pulp) | 0.07 | 0.38 | — | — | Ripe fruit. |
| » (skin) | 0.56 | 5.10 | — | — | do. |
| *Acotyledons:* | | | | | |
| Fern | 2.70 | 8.50 | 123 | 1.44 | Male fern, whole stalk. |
| Cultivated mushroom | 0.84 | 8.40 | 1 237 | 147 | Fresh. |
| Edible boletus | 0.052 | 0.61 | — | — | Fresh. |
| *Other vegetable products: stalk, straw, wood, bark:* | 0.40 | — | — | — | Chiefly from ripe grain crops. |
| Hay | 0.94 | 1.04 | — | — | Ordinary state (ash fused in the crucible with $NaKCO_3$) |
| Wheat straw | 0.34 | 0.40 | — | — | |
| Poplar (wood) | 0.34 | 0.45 | 20 | 44 | |
| » (bark) | 1.30 | 1.40 | 13 | 9.3 | |
| Fir (wood) | 1.45 | 1.75 | 25.6 | 14 | |
| Pine (wood) | 0.59 | 0.66 | — | — | |
| Oak (wood) | 0.48 | 0.59 | 43.5 | 73 | |
| » (bark) | 1.04 | 1.40 | 43.5 | 31 | |
| Birch (wood) | 5.90 | 7.40 | 17.4 | 2.3 | Experiment to be repeated. |
| « (bark) | 0.31 | 0.36 | — | — | |
| Walnut (wood) | 0.60 | 0.71 | 8.7 | 12 | |
| » (bark) | 0.32 | 0.37 | 16.5 | 44 | |

sorrel 612 mgms, dandelion 464 mgms, beetroot 490 mgms, etc. always per 100 grams of leaves dried at 100° C.

The *buds* (cauliflowers and asparagus) are slightly poorer in fluorine: 2.57 mgms and 7.94 mgms to 100 grams of dry parts. The quantity of phosphorus was only ascertained in asparagus, where it reaches the high amount of 76 mgms per 100 gms.

The *stalks*, *wood* and *bark* are the parts poorest in fluorine, the latter ranging from 0.26 to 1.7 mgms per 100 gms. As expected, these tissues are also poorest in phosphorus: acacia wood 8.7 mgms, fir 13 mgms, pine bark 25 mgms, poplar bark 20 mgms, birch bark 17.4 mgms, per 100 grams dry.

The *edible roots* examined contain fluorine and also phosphorus in very variable proportions: *Fluorine*: carrot 0.24 mgms, turnip 2.02 mgms, radish 2 mgms; *Phosphorus*: radish 769 mgms, long radish 268 mgms, per 100 grams dry.

*Pulp Fruits* (edible part) are moderately rich in fluorine: peach 3.93 mgms, apricot 2.50 mgms, cherry 3.70 mgms, tomato 4.06 mgms. Their phosphorus contents are medium: peach 219 mgms, apricot 157 mgms, cherry 159 mgms, apple 63 mgms, per 100 gms in the dry state. In any particular fruit (apple, banana), again dry, the pulp is poorer in fluorine than the skin.

The quantities of phosphorus also increase in the skin or episperm of fruits and seeds as compared with the edible parts.

In the *seeds* the quantities of fluorine are medium, and comparable with those found in the pulp of edible fruits. They vary but little, and independently of the family, as shown by the following figures.

| | Fluorine per 100 gms. dry |
|---|---|
| Wheat flour (according to origin) . . | 1-1.41 mgms |
| Rye » . . . . . | 0.60 |
| Buckwheat » . . . . . | 2.53 |
| Barley . . . . . | 2.20 |
| Rice . . . . . | 0.94 |
| Haricots . . . . . | 2.10 |
| Lentils . . . . . | 1.80 |
| Mustard (seed) . . . . . | 1.58 |
| Cacao (husked) . . . . . | 1.78 |
| Coffee (green) . . . . . | 1.45 |

Granitic soils tend to increase the fluorine contents of grain.

The episperm of the wheat grain (bran) is very poor in fluorine (0.42 mgms to 0.68 mgms per 100 gms of bran), but very rich in phosphorus (1080 mgms to 1102 mgms). This quite unexpected observation will require confirmation by other samples of other cereals. The flours supplied by these grains are generally, like the fruit pulp, moderately rich in phosphorus (wheat flour 134 mgms and 150 mgms per 100 grams dry; rye flour 176 mgms, rice flour 108 mgms).

In the seeds of the Leguminosae the quantities of phosphorus are high. There were found : lentils 500 mgms, haricots 530 mgms, per 100 grams dry. These foods have long been known to be highly phosphoric.

In spite of the array of facts thus brought to light, it has not yet been possible to fix upon any vegetable group in which fluorine should appear particularly necessary and abundant. This is evident from the above Table, in which the results are grouped according to natural families. Nevertheless it is true that in each of them very dissimilar plant organs have been comprised: fruits, leaves, stalks, roots, etc., which have been seen to possess a very different content of fluorine in one and the same plant.

For the different organs of the same plant no simple law can be detected connecting the variations of fluorine with those of phosphorus. As in animals, however, these two elements mostly increase or decrease together. For the same kind of tissue the ratio $\frac{P}{F}$ appears to vary more in the plant than in the animal. It is also observed that this ratio $\frac{P}{F}$ which varies from 350 to 700 in most animal tissues of intense life, is generally much below these figures in vegetable tissues, even where life is most active.

629 – **Comparative Tests of 3 Varieties of Rye at Torestorp, Sweden.** — HJALMAR VON FEILITZEN. in *Svenska Mosskulturföreningens Tidskrift*, Year XXX, No. 1, pp. 55-57. Jönköping, 1916. PLANT BREEDING

These cultivation trials in boggy land at the agricultural Station of Torestorp during 1910 to 1914 were for the purpose of comparing the varieties " Petkuser ", " Grarag " (grey rye) and " Midsommar ". The manure used per acre was: stable manure about $14\,^3/_4$ tons. Basic slag 5.9 cwt, potassium salt (37 %) 3.9 cwt. The rye generally showed great resistance to winter weather, the one exception being in 1910 when late frosts killed the flowering rye, destroying almost the entire crop.

The appended Table contains the results of the trials.

Disregarding 1910, it is evident that in the most favourable years for rye growth the variety " Petkuser " gave a yield higher than that of the two native varieties ; in 1913 and 1914, on the other hand, the winter having been very severe, with frequent frosts, the varieties " Midsommar " and " Grå " proved superior to the " Petkuser " owing to their greater resisting powers.

As to the yield of straw, the native varieties produced much more than the " Petkuser ", which was in turn distinguished by high weight of grain.

" Petkuser " may be advantageously grown in places not much exposed to wind and frost, that is, whenever no special resistance to very low temperatures is needed. For the purposes of such resistance along with good cropping power, the varieties " Grå " and " Midsommar " should be chosen.

*Results of Tests.*

| Varieties | 1910 | 1911 | 1912 | 1913 | 1914 | Average of years 1911 to 1914 |
|---|---|---|---|---|---|---|
| | *Yield of Straw in lbs per acre.* | | | | | |
| Petkuser | 4 400 | 5 025 | 5 873 | 4 071 | 3 730 | 4 675 |
| Grå | 5 622 | 5 670 | 5 772 | 4 426 | 6 814 | 5 670 |
| Midsommar | 5 541 | 5 938 | 6 256 | 4 494 | 5 795 | 5 620 |
| *Averages* | 5 188 | 5 544 | 5 967 | 4 330 | 5 448 | 5 322 |
| | *Yield of Grain in bushels per acre* (bushels of 60 lbs.). | | | | | |
| Petkuser | 5.36 | 45.50 | 50.66 | 24.78 | 25.93 | 36.71 |
| Grå | 4.77 | 44.31 | 39.63 | 29.00 | 41.77 | 38.68 |
| Midsommar | 4.14 | 44.65 | 45.96 | 23.38 | 36.03 | 37.50 |
| *Averages* | 4.76 | 44.82 | 45.42 | 25.38 | 34.57 | 37.63 |
| | *Weight of 1000 grains in grams.* | | | | | |
| Petkuser | 18.1 | 34.0 | 28.4 | 27.9 | 25.3 | 28.9 |
| Grå | 12.2 | 21.8 | 17.4 | 20.9 | 18.0 | 19.5 |
| Midsommar | 12.2 | 22.1 | 17.4 | 19.9 | 17.8 | 19.3 |
| *Averages* | 14.2 | 26.0 | 21.1 | 22.9 | 20.4 | 22.6 |
| | *Weight per bushel in lbs.* | | | | | |
| Petkuser | 45.6 | 57.1 | 52.9 | 50.4 | 57.0 | 54.3 |
| Grå | 46.5 | 59.1 | 54.0 | 52.7 | 58.1 | 55.9 |
| Midsommar | 46.8 | 58.8 | 54.0 | 50.2 | 56.6 | 54.9 |
| *Averages* | 46.3 | 58.3 | 53.6 | 51.5 | 57.2 | 55 |

630 – **Comparative Tests of 9 Varieties of Oats at Torestorp, Sweden.** — HJALMAR VON FEILITZEN, in *Svenska Mosskulturföreningens Tidskrift*, Year XXX, No, 1. pp. 60-65. Jönköping, 1916.

In these comparative tests covering the period 1909 to 1914, 5 varieties of white oats were cultivated: Guldregn, Dala, Ligowo, Leger, Probsteier, and 4 of black oats: Klock, Plym, Mesdag and Tysk Mosshafre (German oats for peat-bogs), a standard phospho-potassic dressing being applied to them every year.

The results of the tests are contained in the following Tables.

*Results of tests,*

| | 1909 | 1910 | 1911 | 1912 | 1913 | 1914 | Average | Averages of years showing results for « Gulden-regn » | Relative average (by « Gulden-regn » standard) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | *Yield of Straw (lbs. per acre).* | | | | |
| *White varieties* | | | | | | | | | |
| Guldenregn . . . | 5 782 | 5 445 | 5 232 | 5 865 | 6 280 | 4 962 | 5 583 | — | 5 583 |
| Dala . . . . . | — | — | — | 5 921 | 5 616 | 3 708 | 5 082 | 5 602 | 4 976 |
| Ligowo . . . . . | 5 123 | 4 513 | — | — | — | — | 4 818 | 5 588 | 4 813 |
| Leger . . . . . | 5 750 | 5 302 | 5 652 | 6 325 | 6 519 | 4 341 | 5 651 | — | 4 754 |
| Probsteier . . . . | 5 455 | 5 232 | 5 216 | 4 780 | 5 865 | 4 341 | 5 136 | — | 6 028 |
| *Black varieties.* | | | | | | | | | |
| Klock . . . . . | 3 941 | 3 153 | 5 378 | 6 004 | 6 474 | 4 488 | 4 908 | — | 4 903 |
| Tysk Mosshafre . | 3 423 | 2 574 | 4 702 | 4 869 | 5 025 | 3 821 | 5 056 | — | 4 056 |
| Plym . . . . . | 4 623 | 3 010 | — | — | — | — | 3 817 | 5 588 | 3 813 |
| Mesdag . . . . . | 36 54 | 2 102 | 5 089 | — | — | — | 3 615 | 5 463 | 3 695 |
| *Average* . . . | 4 719 | 3 918 | 5 211 | 5 627 | 5 963 | 4 277 | 4 741 | 5 660 | 3 847 |
| | | | | | *Yield of Grain (bushels per acre).* | | | | |
| *White varieties.* | | | | | | | | | |
| Guldenregn . . . | 39 | 58 | 80 | 70 | 49 | 61 | 60 | — | 60 |
| Dala . . . . . | — | — | — | 63 | 55 | 51 | 56 | 60 | 56 |
| Ligowo . . . . . | 40 | 41 | — | — | — | — | 40 | 49 | 49 |
| Leger . . . . . | 35 | 55 | 74 | 44 | 42 | 40 | 48 | — | 48 |
| Probsteier . . . . | 42 | 42 | 62 | 51 | 37 | 53 | 48 | — | 48 |
| *Black varieties.* | | | | | | | | | |
| Klock . . . . . | 32 | 45 | 66 | 63 | 57 | 48 | 52 | — | 52 |
| Tysk Mosshafre . | 36 | 30 | 67 | 66 | 42 | 42 | 47 | — | 47 |
| Plym . . . . . | 29 | 46 | — | — | — | — | 38 | 49 | 46 |
| Mesdag . . . . . | 37 | 24 | 69 | — | — | — | 43 | 59 | 43 |
| *Average* . . . | 36 | 42.6 | 69.3 | 59.5 | 47 | 49.16 | 48 | 57.25 | 49.77 |
| | | | | | *Weight of 1000 grains in grams.* | | | | |
| *White varieties.* | | | | | | | | | |
| Guldenregn . . . | 22.5 | 32.4 | 29.4 | 25.7 | 27.0 | 30.5 | 28.1 | — | 28.1 |
| Dala . . . . . | — | — | — | 23.2 | 26.3 | 26.5 | 25.3 | 28.0 | 25.4 |
| Ligowo . . . . . | 27.4 | 37.8 | — | — | — | — | 32.6 | 27.4 | 33.4 |
| Leger . . . . . | 23.9 | 35.5 | 33.9 | 25.1 | 27.7 | 33.5 | 29.9 | — | 29.9 |
| Probsteier . . . . | 27.2 | 32.6 | 34.1 | 28.1 | 26.6 | 32.5 | 30.2 | — | 30.2 |
| *Black varieties.* | | | | | | | | | |
| Klock . . . . . | 21.9 | 32.0 | 27.0 | 25.1 | 29.1 | 27.8 | 27.1 | — | 27.1 |
| Tysk Mosshafre . | 26.4 | 30.4 | 30.2 | 27.9 | 24.0 | 28.6 | 27.9 | — | 27.9 |
| Plym . . . . . | 20.3 | 30.1 | — | — | — | — | 25.2 | 27.4 | 25.8 |
| Mesdag . . . . . | 27.7 | 30.9 | 32.5 | — | — | — | 30.4 | 28.1 | 30.4 |
| *Average.* . . . | 24.7 | 32.7 | 31.2 | 25.8 | 26.9 | 29.9 | 28.5 | — | 28.7 |
| | | | | | *Percentage of grains.* | | | | |
| *White varieties.* | | | | | | | | | |
| Guldenregn . . . | 64.6 | 73.6 | 69.6 | 69.9 | 66.8 | 75.5 | 70.0 | — | 70.0 |
| Dala . . . . . | — | — | — | 65.1 | 64.8 | 71.1 | 67.0 | 70.7 | 66.3 |
| Ligowo . . . . . | 64.4 | 72.5 | — | — | — | — | 68.4 | 69.1 | 69.3 |
| Leger . . . . . | 61,9 | 72.4 | 63.9 | 60.0 | 63.0 | 71.2 | 65.4 | — | 65.4 |
| Probsteier . . . . | 64.0 | 73.7 | 67.1 | 69.2 | 64.4 | 73.9 | 68.7 | — | 68.7 |

*Results of tests.*

| | 1909 | 1910 | 1911 | 1912 | 1913 | 1914 | Average | Average of years showing results for « Guldenregn » | Relative average (by « Guldenregn » standard) |
|---|---|---|---|---|---|---|---|---|---|
| *Black varieties.* | | | | *Percentage of grains.* | | | | | |
| Klock | 63.5 | 69.5 | 63.1 | 69.7 | 66.8 | 71.6 | 67.4 | — | 67.4 |
| Tysk Mosshafre | 70.1 | 71.9 | 68.3 | 71.7 | 61.3 | 70.5 | 69.0 | — | 69.0 |
| Plym | 61.6 | 70.2 | — | — | — | — | 65.9 | 69.1 | 66.8 |
| Mesdag | 72.0 | 71.3 | 69.2 | — | — | — | 70.8 | 69.3 | 71.5 |
| *Average* | 65.3 | 71.9 | 66.9 | 67.6 | 64.5 | 72.3 | 68.1 | — | 68.3 |
| *White varieties.* | | | | *Weight per bushel (lbs.).* | | | | | |
| Guldenregn | 32.1 | 37.9 | 38.0 | 32.9 | 32.1 | 38.9 | 35.3 | — | 35.3 |
| Dala | — | — | — | 31.5 | 34.0 | 38.5 | 34.7 | 34.6 | 35.4 |
| Ligowo | 32.1 | 36.0 | — | — | — | — | 34.0 | 34.9 | 34.4 |
| Leger | 29.5 | 38.8 | 37.3 | 27.0 | 30.6 | 38.0 | 33.5 | — | 33.5 |
| Probsteier | 31.2 | 34.8 | 35.5 | 28.5 | 28.8 | 36.9 | 32.6 | — | 32.6 |
| *Black varieaies.* | | | | | | | | | |
| Klock | 31.3 | 38.5 | 33.6 | 30.2 | 31.6 | 36.0 | 33.6 | — | 33.6 |
| Tysk Mosshafre | 36.5 | 37.9 | 35.0 | 32.5 | 30.6 | 35.7 | 34.8 | — | 34.8 |
| Plym | 29.6 | 37.2 | — | — | — | — | 33.3 | 34.9 | 33.7 |
| Mesdag | 38.8 | 38.5 | 37.3 | — | — | — | 38.5 | 36.0 | 37.7 |
| *Average* | 32.65 | 37.45 | 41.2 | 30.43 | 31.3 | 35 | 34.47 | 34.1 | 34.55 |
| *White varieties.* | | | | *Number of days between sowing and earing.* | | | | | |
| Guldenregn | 72 | 74 | 66 | 70 | — | — | 70 | — | 70 |
| Dala | — | — | — | 67 | — | — | (67) | 70 | (67) |
| Ligowo | 72 | 74 | — | — | — | — | (73) | 73 | (70) |
| Leger | 73 | 74 | 68 | 72 | — | — | 72 | — | 72 |
| Probsteier | 75 | 74 | 71 | 75 | — | — | 74 | — | 74 |
| *Black varieties.* | | | | | | | | | |
| Klock | 73 | — | 71 | 74 | — | — | 73 | 69 | 74 |
| Tysk Mosshafre | 59 | — | 60 | 65 | — | — | 61 | 69 | 62 |
| Plym | 73 | — | — | — | — | — | (73) | 72 | (71) |
| Mesdag | 59 | — | 60 | — | — | — | (59) | 69 | (60) |
| *Average* | 69 | 74 | 66 | 70 | — | — | — | — | 69 |
| *White varieties.* | | | | *Length of vegetative period (days)* | | | | | |
| Guldenregn | 123 | 130 | 102 | 120 | 120 | 107 | 117 | — | 117 |
| Dala | — | — | — | 109 | 114 | 94 | (106) | 116 | (107) |
| Ligowo | 123 | 130 | — | — | — | — | (126) | 126 | (117) |
| Leger. | 123 | 130 | 109 | 126 | 120 | 112 | 120 | — | 120 |
| Probsteier | 123 | 130 | 109 | 130 | 123 | 112 | 121 | — | 121 |
| *Black varieties.* | | | | | | | | | |
| Klock | 118 | 114 | 109 | 125 | 120 | 103 | 115 | — | 115 |
| Tysk Mosshafre | 106 | 114 | 98 | 109 | 114 | 89 | 105 | — | 105 |
| Plym | 118 | 114 | — | — | — | — | (116) | 126 | (108) |
| Mesdag | 106 | 114 | 98 | — | — | — | (106) | 118 | (105) |
| *Average* | 117 | 122 | 104 | 120 | 118 | 103 | — | — | 113 |

The climate of Torestorp, with its frequent spring and autumn frosts, is anything but favourable to the growth of wheat, but in spite of this the crop was really good in some years. Thus, in 1911 and 1912, 2 944 and 2 498 lbs of grain per acre were obtained; in 1914, 1913 and 1910, 2 052, 1 962 and 1 784 lbs respectively; on the other hand, in 1909, the yield was only 1 517 lbs.

As regards the respective values of the different varieties compared, the " Guldenregn " undoubtedly takes the first place, with a six-yearly average of 2 498 lbs of grain per acre. Extremely encouraging results were also obtained with the " Dala " variety selected at Svalöf and tested in 1912-1913-1914; on the other hand the " Probsteier ", except in the years 1909 and 1914, was found unproductive and certainly incapable of any further competition with the best white oats particularly suited for peaty soils; the same may be said of the " Leger ".

Among the black varieties " Klock II " leads, being superior to " Mesdag " and " Mosshafre " (oats for peaty soils); the last two, on the other hand, possess great resistance to frost and thrive even in the worst peat soils.

The quality of the grains generally leaves much to be desired, owing to the spring frosts; the weight of 1000 grains is always very small, as is also the percentage of grains; on the other hand, the yield of straw is good, with a maximum of 50 cwt. for the " Leger " variety. " Mesdag " and "Mtosshafre " are the earliest varieties, " Leger " and " Probsteier " the latest, while " Klock " and Guldenregn " occupy an intermediate place, wih a growing-period lasting on the average 115 to 117 days respectively.

In conclusion, it may be stated that the most suitable variety for the special soil and climatic conditions of Torestorp is beyond all doubt the " Guldenregn ", which is marked out by high yield of grain and straw and the good quality of the grain.

631 – **Cross between a Wild Crucifer and a Cultivated Crucifer with Tuberised Root.** — TROUARD-RIOLLE, in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 162, No. 14, pp. 511-516. Paris, April 1916.

It is easy to produce hybrids between the wild *Raphanus raphanistrum* L. and the different varieties of *Raphanus sativus* L. The plants described by several writers as intermediate between these two species are nothing but their crosses.

The hybridisation of a wild plant (*R. raphanistrum*) with a cultivated plant (*R. sativus*) yielded the same products in the 1st and 2nd generations as the reverse cross. In these species *Raphanus*, therefore, the influence of the sexes does not make itself felt in hybrids.

The first generation of these crosses yielded plants all of which were similar and more or less intermediate between the parents.

In the 2nd generation these self-fertilised hybrids segregated. An average of 65.75 % of the plants obtained were tuberised; 5 to 15 % had reverted to the cultivated type; an average of 34.25 %, on the contrary, returned to the wild type; the rest of the plants retaining mixed characters.

The seeds of one and the same hybrid pod produce plants differing profoundly from each other.

When the wild plant is crossed with a hybrid of different varieties of the cultivated plant, the 2nd generation of the resulting hybrid furnishes both the wild plant, the cultivated cross, intermediate plants and plants recalling the origin of the cultivated cross. Thus, a yellow radish crossed with *R. raphanistrum* yields, in the first generation, plants with black tubers, and in the second generation plants with yellow, black, white, and blackish tubers and the pure wild form.

From these facts the following conclusions are drawn :

1) Hybridisation is an excellent means for artificially tuberising a wild plant.

2) In the hybrid between a cultivated and a wild plant, the wild type tends to become dominant in the progeny of the hybrid plants. This readily explains why a large number of wild forms is sometimes found in the vicinity of an abandoned radish field. There is no degeneration of the radish, but plentiful reversion to the wild species in consequence of crossing.

In the struggle for life, therefore, the more perfect species is at a disadvantage.

632 - **Breeding Farm Crops in Iowa, United States.** — HUGHES H. D., in *The Journal of Heredity*, Vol. VII, No. 3, pp. 143-144. Washington, March 1916.

1) *Oat Breeding.* The present experiments in oat breeding were begun in 1906 (in cooperation with the Bureau of Plant Industry, United States Department of Agriculture). The work consists primarily in isolating and testing pure lines from commercial varieties, and secondly in breeding pure lines from crosses.

Several hundred pure lines have been isolated annually from the various commercial varieties. These pure lines have been tested for growth, vigour and productivity. Those which appeared most promising were bred and tested under field conditions. In all, over 8,000 pure lines have been isolated and tested from 1906 to 1914. 125 pedigree varieties are now included in the variety tests. Two of the most promising have been distributed to farmers in sufficient lots to plant one acre of each, the pedigree oats being compared under field conditions with the best commercial varieties which the farmers have been able to secure. In 1914 the pedigreed varieties " Iowa 103 " and " Iowa 105 " each outyielded the commercial varieties by more than 4 ½ bushels per acre. Prior to 1908, Dr. J. D. NORTON of the " Bureau of Plant Industry " made a large number of crosses. The product of these crosses was transferred to the Iowa Experiment Station in 1909. Several thousand selections have been made and tested in the nursery. The most promising of those that have proved to be pure lines have been bred and are being tested in the various test plots and comparisons made with commercial varieties and other pure lines.

2) *Winter Wheat Breeding.* This project started from a foundation stock of eleven different varieties in 1906. From these, several hundred

pure lines have been selected and tested out annually in head and nursery rows. During the past four years at least 500 heads have been secured annually from fields away from the Station. During the years 1906 to 1914 approximately 8000 pure lines have been tested out and either bred from or discarded. Some 150 pedigree strains are under comparison in plots of one twentieth-acre and others are being compared in tenth-acre plots. Seed sufficient to plant one acre of the two most promising and best growing varieties, " Iowa Nos. 404 and 327 ", have been distributed to each of a number of farmers in various portions of the State, these to be compared with a plot of similar size planted under the same conditions, using the best commercial seed which they could get. In 1913 these pedigree varieties outyielded the commercial sorts by an average of one and a half bushels per acre.

3) *Barley Breeding.* This project was begun in 1911, the object being to produce strains or varieties of barley suitable for brewing purposes and which could be successfully grown on the dry soils of Iowa. The most promising pure lines are now being tested out in head and nursery rows.

4) *Breeding Silver King Maize for Northern Iowa.* This work was begun in the spring of 1910, when 300 of the best ears of Silver King maize which could be secured were planted in ear to row trials. During the five years 1910 to 1914 over 1,000 ears have been tested out in this way. Approximately 10 per cent. of the mother ears showing the best performance have been sown in the crossing plots, the best of these crosses being bred and tested in the field. Some 57 crosses have been tested out at the breeding stations and the progeny of about 10 of these crosses has been distributed to several hundred farmers in the northern part of the State for comparison with their own corn. In 1913 the improved Silver King outyielded all varieties with which it was compared by an average of approximately five bushels per acre.

5) *Reid's Yellow Dent Breeding Work.* From 1905 (the year when the work was begun) to 1914 over 2,000 selected ears of Reid's Yellow Dent maize have been tested out in ear to row plots. The ears showing the best performance are carried over each year to go into the crossing plot. One very desirable strain known as " Iowa 203 " has been developed which, in test trials, has an average of about 12 bushels per acre over ordinary Reid's from which it came. Enough corn to plant one acre was supplied last year to each of several hundred farmers in central Iowa for comparison with their own corn.

6) *Breeding Red Dent Maize.* This investigation, to determine the prepotency of the colour character in Reid's Yellow Dent Corn (Red and Yellow) began in 1913, and has therefore only been under way for two seasons.

7) *Correlation Studies with Maize.* The object of this investigation is to determine the relation between the ear characteristics of seed ears and yield, also the relation between the stalk characteristics of the plant producing the seed ear and the yielding power of the ear. This part of the work was begun in 1907. Though few of these data have been compiled, it is

believed that some rather striking correlations between the character o the stalk and the yielding power of the ear will be found.

8) *Clover Breeding.* This project was begun in 1910 (in cooperatio with the Bureau of Plant Industry, United States Department of Agri culture), when a large number of selections were made from specimen secured in the vicinity of Ames, Iowa. In 1912, various lots of seed com ing from all parts of the world were secured from the Bureau of Plan Industry of the United States Department of Agriculture. These wer planted in nursery plots where individual plants were seeded and the bes individuals isolated for continued breeding and selection. Some fifty five of the best individuals have been multiplied and are being compared fo vigour, leafiness, seed production, and resistance to winter cold and disease

CEREALS AND PULSE CROPS

633 – **Wheat Varieties in Siberia** (1). — FLAKSBERGER C. in *Труды Бюро по прикладной Ботаникѣ* (*Bulletin of Applied Botany*), Year VIII, No. 7, pp. 857-860 (Abstrac in English, pp. 861-862). Petrograd, 1915.

The most widely distributed wheats throughout all Siberia are *Triticum vulgare* Vill. vars. *ferrugineum rossicum* Flaksb., and *lutescen poltawense* Flaksb., then *erythrospermum* Körn. and *milturum* Al. I cultivation these forms occur in mixtures. Occasionally some of them predominate in the crop, but there also cases where no predominance could be observed. As admixtures there are found *Tr. vulgare* vars *graecum* Körn (from Turkestan), *leucospermun* Körn. (seldom), *hostianum* Clem. (from Turkestan), *fuliginosum* Al. (very seldom, from Turkestan) *caesium* Al. (local form), *alborubrum* Al, (seldom), *albidum* Al. (seldom) *barbarossa* Al. (very seldom, from Turkestan), *nigroaristatum* Flaksb. (lo cal form), *sardoum* Körn. (seldom).

As predominant forms are cultivated around Toboljsk and Tomsk (except in the northern part): *Triticum durum* Desf. vars. *hordeiforme densius culum* Flaksb., *hordeiforme laxiusculum* Flaksb. In the same locality can be found *Tr. durum* var. *coerulescens* Bayle as a predominant form in the field crop. The same is to be said of the distribution of *Tr. durum* var. *melanopus* Al. in Akmolinsk and Semipalatinsk provinces. This variety is found in the governments of Toboljsk and Tomsk, in sometimes considerable amounts.

*Tr. compactum* Host var. *icterinum* Al. is to be found throughout all Siberia mixed with other varieties, but is almost never found as a predominant form in the crop. As a mixture can be found: *Tr. compactum* vars. *erinaceum* Desv. (Turkestan); *fetisowi* Körn. (found separately, from Turkestan), *creticum* Mazz. (found separately). It is to be generally observed that the cultivation of *Tr. compactum* Host in Siberia is now replaced by that of *Tr. vulgare* Vill.; *Tr. turgidum* L. vars. *lusitanicum* Körn. and *plinianum* Körn. are to be found among the crops of several farmers in different provinces.

*Tr. polonicum* L. var. *villosum* Desv. is found among crops of several

(1) See also *B.* Dec. 1915, No. 1270. (*Ed.*)

armers. *Tr. spelta* L. is not to be found in Siberia. *Tr. dicoccum* Schrank var. *farrum arras* Hoscht. and *rufum maturatum* Flaksb. are to be found, although very rarely. *Tr. monococcum* L. is not to be found in Siberia.

634 – **Growing Manitoba Wheat in the Haute-Marne, France** (1). — *Feuille d'Information du Ministère de l'Agriculture*, XXIst Year, No. 14, pp. 13-14, Paris, 4th April 1916.

Manitoba wheat having been recommended for spring sowing in France, without any trials having been made beforehand, merely on a comparison of the weather conditions of Manitoba and France, the following facts reported by M. CASSEZ, director of Agriculture for the department of Haute-Marne, deserve careful consideration :

Manitoba wheat was first grown in the Haute-Marne in 1912, on the " Ferme de la Salle " (commune of Auberive), a farm run by M. GAUVAIN. This farm, which is located close to the source of the river Aube at an altitude of 1411 ft, lies on the Lower Oolite. The soils are shallow marls, sometimes highly calcareous, on a rock or gravel subsoil. The trial made in 1912 with 4 cwt of seed was followed up in 1913, 1914, and 1915, the grain from the previous crop being sown after a preliminary cleaning only.

In 1915, sowing was done in February and March. In 1913, it had been prolonged until the 12th April, but this seems a rather late date for the Haute-Marne. The quantity of seed used was the same as that employed for the autumn sowing of the wheats " blé blanc de Louesmes " and " Bon fermier ", namely 2.67 bushels per acre. The Manitoba yielded good results, the yield being equal to that of the acclimatised variety " de Louesmes ", and always superior to that which would have been given by autumn varieties sown under rather unfavourable conditions.

Another farmer in that region, M. BÉGIN, of Vivey, had also sown 11 ½ bushels of Manitoba wheat on March 12th 1915. He was satisfied with the crop, although it was a little below that of the Louesmes autumn wheat. On the strength of this result he decided to sow some Manitoba on the 20th March in 1916 in a fairly fertile soil of moderate depth, on a rocky subsoil, which had not been tilled in time for autumn sowing. Up to the present, both M. GAUVAIN and M. BÉGIN are satisfied with the growth of the Manitoba wheat on their comparatively thin and dry soils.

635 – **A Remarkable Cultural Variety of Rye in the Upper Valley of Dora Riparia, Italy.** — CERRIANA C. F., in *Il Coltivatore*, Year 62, No. 12, pp. 358-362, figs. 66 and 67. Casale Monferrato, April 30, 1916.

From Chiomonte to Oulx and from Oulx to Cesana and Bardonecchia, a variety of rye is under extensive cultivation which deserves to be brought under notice owing to its productivity, behaviour and yield of flour.

This variety differs from common rye in the following characters : culms shorter, leaves darker and wider, ears denser, grains larger and full, greenish in colour even when fully ripe, higher yield of grain (15 to 16 cwt per acre in the above region), whiter flour, furnishing a whiter bread.

This rye is sown in August or September ; it germinates quickly and

(1) See also *B.* May 1916, No. 510. (*Ed*).

vigorously, and tillers plentifully, so much so as to form a bush-like growth. Owing to the climatic conditions of the above region, it is on the ground for a very long time between sowing and cropping, this time, in some localities, exceeding 12 or 13 months.

The qualities of this variety induced the Agricultural Travelling Lecturer's Institute to subject it to cultivation tests between 1906 and 1908 and then to advise farmers in the plain to sow this mountain rye. This was done by several members of the " Consorzio agrario cooperativo " of Turin, who were asked to state the results of their trials on a special form. The replies sent to the travelling Lecturer's office of Turin led to the following conclusions :

1) This mountain rye is a variety with high yield, extremely suitable for poor, dry and wind-exposed soils.

2) Put down in equal mixture with ordinary rye, it is also suitable for fertile soils, provided they are not exposed to excessive humidity and to fog.

3) As the characteristic qualities of this mountain rye disappear or fall off after the 2nd reproduction outside its natural environment, the seed must be renewed every 3 years.

636 - **Influence of Methods of Sowing Oats on Crop Yield ; Experiments in Russia.** — ARCHANGELSKIJ, M., in *Земледѣльческая Газета* (*The Agricultural Gazette*), No. 12, pp. 313-318. Petrograd, March 19, 1916.

In 1914, the agricultural experiment Station of Tambov (Russia) experimented with 3 different methods of sowing: 1) broadcast ; 2) ordinary sowing in rows ; 3) sowing in sets of rows alternating with bare strips varying in width up to about 12 inches. The quantity of seed sown ranged from 0.60 to 1.41 cwt per acre.

The water content of the soil down to the depth of about 3 ft. was determined during the summer in order to ascertain how the various methods of sowing influence the water content of the soil and whether cultivating the bare strip helps water-conservation.

*Results of the Experiments.* — 1) With an equal quantity of seed, ordinary sowing in rows gave the largest yields, and broadcast sowing the smallest ; sowing in sets of rows alternating with bare strips gave intermediate results, which were better when the strips were broad.

2) Increase in the quantity of seed used (within the limits laid down for these experiments) influenced the yield. The maximum was 1.41 cwt of seed per acre, sown in ordinary rows.

3) Periodical superficial ploughing of the bare strips ensures better conservation of soil-moisture and increases the yield.

637 - **Trials of different Varieties of Maize at the Royal School of Agriculture of Caluso, Italy.** — BOCHICCHIO N., in *Il Coltivatore*, Year 62, No. 10, pp. 307-309. Casale Monferrato, April 10, 1916.

Practical trials in a field previously under wheat. The mellow, somewhat stony soil was manured with red clover and rape plus 159 cwt of stable manure and 4 cwt of superphosphate per acre. Sowing was done at

he beginning of May, a space of 21 × 7 inches being left between owings and the roller taken over immediately ; hoeing was carried out arly in June and moulding up on the 15th June. The maize was cropped from the 8th to the 10th September. Each trial plot measured 3456 sq feet, except two of 3228 sq feet sown with white " Varesotto " and yellow " Varesotto ". After removing the spathes and properly drying and shelling the ears, the results were as shown in the following table.

*Results of Trials.*

| Varieties | Yeld of grain per acre | Percentage of grain by weight | Weight of 1 bushel of grain | Height of plants | Weight of 100 ears |
|---|---|---|---|---|---|
| | cwt. | per cent | lbs. | ft. | lbs. |
| Native . . . . . | 26 | 77.4 | 59 | 9.10 to 9.92 | 4.84 |
| « Bresciano » . . . . . | 33 | 77.7 | 58 | 9.10 to 9.75 | 5.43 |
| « Pavese grosso » . . . | 32 | 68.3 | 58 | 6.6 to 6.86 | 7.27 |
| « Pignoletto » . . . . . | 36 | 74.4 | 70 | 9.10 to 9.75 | 5.72 |
| White « Varesotto » . | 43 | 75.4 | 58 | 5.92 to 8.89 | 4.81 |
| Yellow « Varesotto » . | 35 | 76.5 | 59 | 5.89 to 7.58 | 7.50 |

The variety which gave the best yield therefore was the white " Varesotto ", closely followed by the " Pignoletto " ; their grains are heavier and more in demand. The native variety of " Veronese riprodotto " is last in yield but one of the best in point of quality of grain.

At the present price of 10 *s.* 6 *d.* per cwt, the crop per acre (average of all the varieties tested) represented a value of £ 17. 3 *s.* 4 *d.* as against a cost of production (labour and manure) of £ 11. 7 *s.* per acre.

638 - **Particulars of Rice-growing in Sumatra.** — Smits, M. B., in *Teysmannia*, Year XXVI, Part 10, pp. 619-625. Batavia, 1915.

The exportation of rice from Sumatra has of late years grown to be of prime importance to some parts of that island. It totals some 6 000 tons per annum, whereas in 1910 the exports were almost non-existent.

Some particulars are given as to this cultivation in Sumatra, differentiating it from the cultivation methods practised in Java.

The nursery beds are always unirrigated. When transplanting the rice to the fields 10 to 20 plantlets are put down in each hole at distances of 16 to 20 inches. In Java the planting is closer (5 to 6 inches apart) and more than 5 plantlets are rarely dibbled in together. After transplanting, irrigation water is let in freely, but as soon as the secondary stalks have appeared the water is run off. After this no more irrigation water is let in until the first ears appear. As soon as the ears yellow and are nearly aripe the wter is again shut out.

By this method of intermittent irrigation a more regular ripening is

secured, so that the crop can be cut with the scythe. Ripening does not take place so regularly on the permanently irrigated rice fields of Java. The crop is then gathered ear by ear, the ripe ears being selected each time. This method entails much greater labour and time than with the scythe.

STARCH CROPS

639 – **New Method of Economic Cultivation of the Potato.** — CADORET ARTHUR (Directeur des Services agricoles du Cantal), in *Le Progrès Agricole et Viticole*, Year 37, No. 15, pp. 355-356. Villefranche (Rhône), April 9, 1916.

Under present market conditions it becomes exceedingly important to obtain a normal production of potatoes with the least possible quantity of seed. Various methods are suggested for this purpose, but the fact is too often forgotten that the method must be adapted to the soil.

The writer recalls the AIMÉ GIRARD method (planting at distances of 24 × 24 inches of entire tubers weighing 2.8 to 4.2 ounces) which gives excellent results in well prepared, deep, fertile and fresh soils ; and the CH. ALLIER method (planting at distances of 4 × 20 inches or 8 × 24 inches of 2 or 3 eye cuttings, weighing 1.76 to 2.11 ounces, from large tubers). This method, formerly adopted in the School of Practical Agriculture of Avignon (France), in irrigated soil, gave excellent results.

The writer then describes his own method, consisting in planting budding stalks instead of tubers, which he has tried in the " Ardèche " for several years and obtained good results. The tubers are sorted out and spread in a dry cellar at a temperature above 17° C. (63° F.) if possible. In a few days, before the tubers wrinkle, rooting sprouts are obtained, which must be cut before they reach a length of 8 inches.

After cutting, they must be planted as quickly as possible. The sprouts are planted in twos on the ridge sides at distances of 8 × 20 inches at a depth of $2\,^3/_4$ to $3\,^1/_2$ inches, according to the soil. In a few days the outside part becomes green and puts out one or two stalks, the roots taking hold at the same time. Each planted shoot gives one or two tubers which are seldom very large, but never small ; a crop of nearly $8\,^1/_2$ tons per acre of marketable potatoes may be reckoned on. The method is applicable to all loose, light and relatively dry soils. Its advantage is that it leaves for consumption those potatoes which, on the ordinary method, would have been used for planting. The shoots given off by the potatoes on germinating keep or several days, and can be planted direct, or even forwarded some distance for planting.

FORAGE CROPS, MEADOWS AND PASTURES

640 – ***Cytisus spinescens* as Winter Forage.** — *El Agricultor*, Revista de Agricultura, Year X, No. 105, pp. 25-26. Riotorto-Lugo, February 1916.

*Cytisus spinescens* (" aliaga " or " aulaga ") grows wild throughout Spain, providing one of those rare green forages available during the whole winter. Its cultivation is advised in lands too poor for lucerne. When cultivated, it yields two crops per year, supplying from 240 to 320 cwt of green forage per acre. The disadvantage presented by this plant is that it has prickles which it is not found possible to get rid of satisfactorily by cutters or crushers. Good results on the contrary are obtained with the centrifugal triturator and defibrator which breaks the prickles and reduces the forage to a green mass very much liked by livestock.

641 – **The Cotton Plant in the Russian Empire.** — IUFEREV V. I. in *Земледѣльческая Газета* (The Agricultural Gazette), Nos 50 (114) and 52 (116), pp. 1374-1378 and 1429-1439. Petrograd, December 1915.

In Turkestan and Transcaucasia, the cultivation of the cotton plant dates back to remote times, but is of very small importance. In Transcaucasia the first attempts at improvements started in the first half of the 19th century, and not till later in Turkestan. For want of co-ordination these trials had little result, and it is only 5 or 6 years since the Department of Agriculture adopted a series of thoroughly co-ordinated measures for the improvement and extension of this crop in the Russian Empire. While, up to the end of the last century, the sums appropriated in the budget for cotton-growing were ridiculously small (not exceeding £ 1 587 or £ 1 984 per annum), since 1910 they have rapidly increased, attaining in 1913 more than £ 59 524. In this way, the Department of Agriculture has been able to organise more thoroughly the institutions for experiments on the cultivation of the cotton plant, by transforming the 2 test fields already existing in Transcaucasia and Turkestan into experimental stations and, further, by creating 3 new institutions in Turkestan in 1913, namely: the cotton selection Station in Fergan, the centre of the cotton region, and 2 experimental fields. In 1914 work was begun for the establishment of a Station for studying brackish soils, so that almost all the principal cotton regions of Transcaucasia and Turkestan already possess their special experimental institutions.

Side by side with the development of the experimental portion, propaganda work was organised among the population and measures were taken by which the results of the experimental institutions might be applied in practice. For this purpose the staff was largely increased : in 1915 it comprised 15 specialists and 35 instructors in Turkestan and Transcaucasia. The number of demonstration fields and depots for machines to be let out on hire was increased. In addition, in order to promote the use of improved seeds, farms were established for the production of cotton seeds. The number of these farms in Turkestan alone is at present 15, with an area of 1 087 acres and an annual production of 7 873 cwt of seed, which is distributed to cotton growers. Towards 1890, the production of cotton in Transcaucasia and Turkestan was 8 786 tons, that is to say ⅓ of the total quantity required by the Russian cotton industry at that time. For the years 1911 to 1913, the comparison between the production of cotton in Russia and its importation from abroad is given by the following table :

| Years | Cotton imported | in the Russian Empire Cotton produced |
|---|---|---|
| 1911 . . . . . | 3 991 285 cwt | 4 336 602 cwt |
| 1912 . . . . . | 3 540 215 | 4 581 965 |
| 1913 . . . . . | 3 876 179 | 4 690 622 |

In those years, therefore, home-grown cotton exceeded one half of the quantity required by the Russian cotton industry, in other words, cotton-growing in the Russian Empire developed more rapidly than the cotton industry.

Among the causes which contributed to the development of this crop in Russia there must be mentioned : agricultural measures of a technical character, railway development, influx of capital, and the irrigation work carried out after the annexation of Caucasia and Turkestan to Russia ; these factors taken together afforded the possibility of irrigating about 457 000 acres. Another cause, and the one perhaps which gave the greatest impetus to the development of this crop in Russia, was, in the writer's view, the duty on imported cotton. Having been fixed in 1878 at 2 ½ shillings per cwt of pure staple, in 1900, by gradual increases, it attained the amount of £ 1 4*s.* 10*d.*

The price of the cotton bought by Russian factories being regulated by the price of foreign, especially American, cotton, the adoption of the import duty, assessing the average yield of pure staple at 2.10-2.39 cwt per acre, meant a premium of £ 7. 14*s.* to £ 3. 2*s.* per acre cultivated, to the growers of Turkestan and Transcaucasia. In 1915 this protective duty was increased to £ 1 16*s.* 11*d.* per cwt.

CROPS YIELDING OILS, DYES AND TANNINS

642 – **Cultivation of *Fourcroya gigantea* in the State of Rio de Janeiro, Brazil.** — FERREIRA BENTO in *O. Fazendeiro*, Year VIII, No. II, pp. 314-316, 2 figs. San Paulo, November 1915.

In 1903 the cultivation of " pita nacional " or " pita común " (*Fourcroya gigantea*) began in the state of Rio de Janeiro (municipality of Vassouras), on an area of 205 acres. In reply to an enquiry of the Ministry of Agriculture, the following particulars are given about this crop.

1 acre contains about 750 plants at distances of 5 ft. 3 in. each way The cultivation work consists in 2 hoeings in the first year, 1 in the second, but none afterwards. The first crop was cut at the age of 5 or 6 years according to the growth of each plant. The crop is taken off twice a year, 20 leaves per plant being removed. A leaf averages 80.5 oz. in weight and furnishes on the average 1.2 oz. of fibre. One workman will cut 2 000 leaves per day. The fibre, which is used in rope making, fetches 8 ¾ d. per lb on the market in Rio de Janeiro. Tested in different European countries, it was declared to be of superior value. Hitherto it has not been exported.

643 – **Queensland-grown Copra.** — *Queensland Agricultural Journal*, New Series, Vol. V, Part I, p. 38 ; Vol. V, Part 2, pp. 98-99. Brisbane, Jan. and Feb. 1916.

An analysis of copra from coconut received from the Kamerunga State Nursery at Cairns, Queensland (1st sample) and one of commercial copra from Double Island nut, near Cairns (2nd sample) yielded the following results :

| Sample | Moisture | Oil |
|---|---|---|
| 1 | 5.2 % | 62.8 % |
| 2 | 4.7 | 57.8 |

There were also analysed separately 5 ripe and 2 green nuts from the Kamerunga State Nursery, and in the air-dried kernel there were found the following percentages of dry material and oil :

| | Dry Substance | Oil |
|---|---|---|
| Ripe nuts | 44.6 — 75 % | 39.5 — 60.0 % |
| Green nuts | 20.0 — 48 | 45.0 — 60.4 |

In sun-dried copra of different origin the average percentages of oil are :

| Origin | Oil |
|---|---|
| Philippines | 60.3 % |
| Cuba | 63.0 » |
| East Indies | 61.8 » |
| Mauritius | 52.0 » |

Queensland-grown copra consequently compares very favourably with that from the other principal growing countries.

Another sample of copra from nuts received from the above State Nursery at Cairns, was sent to the Imperial Institute in London for analysis. The results were : 4.4 % of moisture and 64.6 % of oil yield equivalent to 67.6 % of the dry copra. The oil possessed the usual character of coconut oil, and was of good quality. The copra was valued at £25 per ton by one expert and £24.15.0. by another (c. i. f. London, October 1915), being slightly below Malabar and slightly above Zanzibar copra. It is advised that the kernel should be cut up small and better dried, reducing the moisture to 3 %.

These facts completely refute the contention of certain writers that Queensland grain coconuts do not contain enough oil to have any commercial value.

644 - **Sesame-growing in Sicily.** — CATALANO G., in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. II, Part 3, pp. 147-153. Palermo, 1915.

The cultivation of sesame (*Sesamum indicum*) was introduced into Sicily by the Arabs about the VIIIth century A. D. and was of great importance for some time. At present it is almost exclusively confined to some districts of the province of Syracuse (Ragusa, Vittoria, etc.) where it represents a part of the northern limits of this crop, and is also carried on to a small extent in other parts of Europe : Malta, Greece, and Turkey. The production not being sufficient for local consumption, large quantities of sesame are imported from East Africa. The Sicilian product is very much more in demand than the foreign owing to its quality, and may fetch as much as £1 16 *s.* 2 *d.* per cwt, as against £1 8 *s.* for the foreign. In Sicily, the seeds are used in preparing pastry, biscuits and other similar articles.

It is thought that this plant deserves to be more widely grown, and a description is given of its cultivation and the commercial treatment of its seeds as practised in the principal producing countries.

645 - **Thinning out *Hevea* Plantations.** — HAMAKER, C. M., in *Mededeelingen van de Vereeniging Rubberproefstation West-Java*, No. 3, Bandoeng, 1916.

RUBBER, GUM AND RESIN PLANTS

A method is described for selecting the Hevea trees to be cut down when thinning out dense plantations.

Some planters have proposed to cut down all the trees along a given line. The writer holds that it is better to sort them out first, estimating the latex yield of each tree by tapping: an attendant catching up the latex in a glass measure. The result of the tapping is marked in yellow or red on the tree by a given sign. The trees are classified in 5 categories according to the results obtained. This trial tapping is repeated some time later, and from the accumulated marks on the tree it is easy to see whether the latter is a good producer. By getting rid of the bad producers the necessary thinning out is secured, and at the same time the average yield of a given stand is considerably increased.

Under the labour conditions in Java, the cost of porting does not exceed 8*s.* 11*d.* per acre. One labourer can tap 200 trees per day.

SUGAR CROPS

646 - **Relative Richness of a few Kinds of Sugarcane in Queensland, Australia.** — *Queensland Agricultural Journal*, New Series, Vol. V, Part 2, pp. 100-101.

At the request of the Mackay Manufacturers Association of Mackay, Queensland, the Central Sugar Experiment Station of Mackay in 1913 undertook comparative growing trials and analyses of crops of different varieties of sugarcane cultivated in that district; among these varieties "Cheribon" and "Oramite" form a large proportion of local production, but are not much cultivated outside the Mackay district. Month by month, from June to December, 8 to 14-month-old canes were tested both in 1914 (plant crop) and in 1915 (first ratoon crop). From two tables giving the detailed results there were obtained the averages reproduced in the following table. By early planting is meant planting in March; by late planting, planting in August. It will be seen that in both years the first three varieties clearly surpassed the last three.

*Result of Tests — Average of 7 months' analyses.*

| Varieties | Plant crop | | 1st Ratoon crop | | | |
|---|---|---|---|---|---|---|
| | Early planting | Late planting | Early planting | | Late planting | |
| | Pure obtainable cane sugar | Pure obtainable cane sugar | Pure obtainable cune sugar | Quotient of purity | Pure obtainable cane sugar | Quotient of purity |
| H. Q. 426 | 16.0% | 16.6% | 18.4% | 91.5% | 18.8% | 92.5% |
| Badila | 15.1 | 16.6 | 19.8 | 92.6 | 18.7 | 91.5 |
| Goru | 13.2 | 13.9 | 17.0 | 90.5 | 16.4 | 89.0 |
| Cheribon | 12.6 | 12.6 | 15.6 | 87.4 | 15.5 | 85.6 |
| Malabar | 11.8 | 11.8 | 15.0 | 87.8 | 15.3 | 86.4 |
| Otamite | 11.0 | 11.4 | 15.0 | 88.1 | 15.0 | 86.8 |

647 – **Absorption and Loss of Nitrogen in Java Sugar Cane Plantations after Manuring with Sulphate of Ammonia or Nitrates.** — VAN HARREVELD-LAKO C. H., in *Mededeelingen van het Proefstation voor de Java Suikerindustrie, Archief voor de Suikerindustrie in Nederlandsch-Indië*, Year XXIV, Part 6, pp. 177-204 ; Part 7, pp. 207-216. Soerabaja, February 1916.

The question of the absorption and loss of nitrogen in the soil after the application of nitrogenous manure is of prime importance in the cultivation of the sugar cane in Java, where every year at least 50 000 tons of sulphate of ammonia are used, costing about £ 635 000 for a cultivated area of 246 954 acres.

I. In a series of specimens from different districts under sugar cane the loss of nitrogen occurring on mixing a solution of sulphate of ammonia with the soil was determined.

For the purpose of analysis 50 gms of dry earth are first mixed with 50 cc. of water and the whole afterwards with 50 cc. of a $^1/_5$ normal solution of sulphate of ammonia. The mixture is regularly shaken up for 2 days, then filtered, and, by distillation, the amount of ammonia in 20 cc. of the filtrate is ascertained. Multiplying by 14 the number of cc. of decinormal ammonia obtained by distillation (it should be below the limit 20), the coefficient of absorption of nitrogen is ascertained.

Analyses made show that for the majority of soils with a coefficient of absorption exceeding 140, no loss need be feared. Some lands with a coefficient below 80 might sustain a loss under particularly unfavourable circumstances, such as torrential rains or floods.

Soils of coarse texture have a low coefficient of absorption and a fairly considerable loss of nitrogen. On applying a heavy dressing of manure, the loss of nitrogen increases.

On determining the coefficient of absorption by a given soil, it may be ascertained to what extent manuring with sulphate of ammonia may be effective without entailing a considerable loss of nitrogen.

II. Contrary to the nitrogen in sulphate of ammonia, that of nitrates is not absorbed by the soil. It having been necessary, owing to the present war, to replace sulphate of ammonia by nitrates in sugar cane plantations, it was thought desirable to study the various soils utilised for sugar cane growing from the standpoint of absorption of the nitrogen from nitrates.

It was found that none of the soils analysed had any high coefficient of absorption. On subjecting the same soils with nitrate added to leaching for 3 days, a considerable quantity of nitrogen from the nitrate, it was found, had been leached out.

The conclusion drawn from the investigations is that the use of nitrate of soda in tropical countries during or before the rainy season is of no advantage. The employment of nitrate of potash on permeable, highly irrigated soils is also not to be recommended.

In Europe the action of nitrates is more rapid and effective than that of sulphate of ammonia. In the tropics, where nitrification is so rapid, this difference in the behaviour of sulphate of ammonia is unimportant.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL CROPS

648 – **Judging the Quality of Tea from Certain Characters.** — DEUSS M. J. B., in *Mededeelingen van het Proefstation voor Thee*, No. 42. Batavia, 1915.

A study of the chemical characters of tea was undertaken in order to ascertain whether these characters could furnish indications as to the quality of the tea. The results were not satisfactory, but some important facts were brought to light.

The determination of theine, for instance, may serve to detect adulteration. For a good quality Java tea the proportion of theine should not be below 3 %.

The percentage of mineral substances is also no basis for judging the quality, as is proved by comparing the results of analyses and the prices of the same tea on the market.

A negative result was also arrived at on determining the quantities of soluble substances and tannin.

The investigations will be continued with the volatile oil distilled from the leaves of the tea.

In some European countries it has been thought that adulteration of the tea could be detected by the quantity of stalks (partly lignified) of the tea-leaves. This idea is proved to be erroneous, as many samples of a superior tea of high value contained a relatively much greater quantity of leaf-stalks or fragments of young stalks than teas of poor quality.

It is concluded from these enquiries that in the case of tea, just as in that of wine, tasting is so far the sole method of determining quality.

649 – **Coffee-tree Grafting in Java.** — VAN HELTEN W. M., in *Mededeelingen uit den Cultuurtuin*, No. 4, 11 pp., 5 figs. Buitenzorg, 1915.

For the past few years almost all coffee-trees of recognised high quality have been grafted in the trial Garden of Buitenzorg (Java). After repeated experiments in order to make sure of having good trees to serve as grafting-stocks, the latter were confined to 2 varieties : " Excelsa " and " Dyboroskii ".

For scions, preference was given to thoroughly sound terminal shoots with 5 or 6 nodes ; they are cut midway through the internodes and the 2nd, 3rd and 4th pieces with node are used as scions.

The method which gave the best results was simple cleft grafting. The wound is carefully ligatured, but there is no need to cover it with mastic. The grafts are then protected against drying by enclosing them in a glass tube.

The hosts are young coffee plants about 2 feet high, topped to 25-30 centimetres.

The grafted plants are kept under shelter for some months before transplanting, and this system ensures 90 % of success.

The method may be simplified by using nursery plants as grafting stock.

650 – **Trials of Hop Cultivation in Italy.** — GUSELOTTO A., in *L'Italia agricola*, Year 53, No. 4, pp. 163-168, 6 figs. Piacenza, April 15, 1916.

In 1914 the consumption of beer in Italy was 16 207 994 gallons, of which 1 834 766 were imported from Germany and 14 350 050 of native

manufacture. For this product 322 752 cwt of malt and 3937 cwt of dried hops were used. The malt had hitherto been imported almost entirely from Austria-Hungary and the hops from Germany. The standard average prices per cwt were: 16 *s.* for malt and £ 14. 2. 4. for dried hops; the value of the two imported substances therefore may be put at over £ 300 000. Adding to this the value of the imported beer, the figure of £ 480 000 is reached. The present number of breweries in Italy is 83. These figures demonstrate the economic importance for Italy of home-growing of brewing barley and hops.

With the object of encouraging the industry, the Agricultural Travelling Lecturer's Institute in Milan, in concert with the Chamber of Commerce, has encouraged a number of trials in the growing of brewers' barley by granting premiums.

The writer, who is director of agriculture for Feltre, started hop-growing trials in the spring of 1914 near Pedavena (Feltre, prov. of Belluno), on an area of somewhat less than an acre. The results having been excellent, this area was doubled in 1915 and raised to 2 ½ acres in 1916.

The loose soil was prepared at the end of the winter by deep ploughing all over and by digging ditches running north to south, 3ft 3 ins. wide and 1 ft 10 ½ ins. deep, half at 5 ft and half at 6 ft 7 ins. intervals. Planting was done in the second half of March. The whole of the subsoil (about 11.82 inches) was turned over into the ditches, and short stable manure supplemented by a plentiful supply of superphosphate was spread over it. A light layer of earth was then put down, on which the pieces of germinated roots were placed at 3 ft 3ins. distance from each other, and at once lightly covered to ensure quicker budding, which was rapid and uniform. When the young plants had reached a height of 12 ins. they were given a top dressing of sulphate of ammonia, and the earth put up in hillocks. This made the depth of the plantation about 9 ¾ ins. The after management consisted of crushing the excess of shoots at the foot, and 2 light hoeings, one in May and the other in July.

In 1914, the two early varieties originating from " Hallertauer " and " Rottenburger Frühhopfen " were used for experiment. The former having been found more adaptable as well as earlier and more productive, was alone employed in the following years. In rows 6 ft 5ins. apart the plants were stronger, more productive and healthier than those in closer rows. It is advised that cropping should be begun at the end of August or the beginning of September, and should be carried out in several operations at intervals of 4 or 5 days. Drying is done on the hurdles commonly used for silkworms, shaking the hurdles once or twice a day and closing the windows of the premises during wet days and the night; the drying was completed by spreading the hops on the ground in these houses in layers a few centimetres thick, and stirring them gently once or twice a day with rakes or sticks. The dry hops may be either kept in heaps or put into wide-mesh sacks hung from the ceiling.

After the flowers have been gathered, the plants are cut 10 or 12 ins. from the foot. Several shoots are given off in spring from the foot of each

plant; the best of them are left for the next crop, the others being removed with a piece of root for planting anew, or else cut flush with the ground and used as a vegetable.

A description is finally given of a reliable pole invented by the writer, which has been found practical, strong and cheap.

The total cost, comprising planting, cultivation and complete poling of the first hop field of 2990 sq. yd. was £35 including the price of transport of the imported roots. The crop of dried cones was 176 lbs. in the first year and 594 lbs. in the second year; the gross profit was £22 in 1914 and £80 in 1915.

651 – **The Principal Problems in relation to Medicinal Plants and their Active Principles.** — IVANOV, in *Сельское Хозяйство и Лѣсоводство* (*Agriculture and Sylviculture*), Year LXXVI, Vol. CCL, pp. 84-107. Petrograd, January 1916.

Russia, like many other countries, was compelled by the present war to give the keenest attention to the problem of cultivating medicinal plants and improving such cultivation so as to suffice for the needs of the country. The Department of Agriculture took up the question, and in March 1915 it convened a Commission of specialists which drew up the following programme of action:

1) Publication of wall plates, propaganda pamphlets and special works on the cropping, cultivation and preparation of each medicinal plant.

2) The organisation of local lectures and consultations on the spot, especially in localities where the industry seems likely to develop or has already developed.

3) The introduction of facts relating to medicinal plants and perfumes, allowing for local conditions, into the syllabus of temporary courses of instruction for those interested.

4) The introduction of optional instruction in the cultivation of medicinal and perfume plants in the curricula of higher Schools of Agriculture, in order to provide a specially trained staff, at any rate for experimental institutions. The Commission further recognise the necessity: (*a*) of encouraging the initiative of institutions and private persons wishing to devote themselves to developing the cultivation of medicinal and perfume plants; (*b*) to offer prizes for farms conducting such cultivation on rational methods; (*c*) if possible, to create, at the earliest possible moment, a body of instructors to teach the population suitable methods of utilising medicinal plants; (*d*) to make use for analytic investigations not only of the laboratories of agricultural experiment Stations but also of those of the Schools of agriculture and those belonging to institutions and private persons. With a view to checking the contents of active principles, it has been proposed to create at least 4 experimental Stations, one in each of the following regions: Middle Russia, Southern Russia, the Caucasus, and the Transcaspian region.

The writer, adopting this programme in principle, emphasizes the necessity of vesting the duties of a central institution in one of these me-

*Distribution of Alkaloids in some Ranunculaceae.*

| Species | Hydrastina | Berberina | Aconitina | Anemonina | Adonidina |
|---|---|---|---|---|---|
| *Hydrastis canadensis* | + | + | | | |
| *Caltha palustris* | | + | | | |
| *Aconitum napellus* | | | + | | |
| *A. barbatum* | | | + | | |
| *A. lycoctonum* | | | + | | |
| *Anemone nemorosa* | | | | + | |
| *Pulsatilla pratensis* | | | | + | |
| *P. vulgaris* | | | | + | |
| *Adonis vernalis* | | + | | | + |
| *Ranunculus acris* | | | | + | |
| *R. sceleratus* | | | | + | |
| *R. flammula* | | | | + | |
| *R. bulbosus* | | | | + | |
| *Berberis vulgaris* | | + | | | |
| *Mahonia aquifolium* | | + | | | |
| *Paeonia* sp. | | + | | | |

The sign + signifies the presence of the corresponding alkaloid.

dicinal plant experiment Stations in order to organise and properly co-ordinate all the scientific work, and prevent needless waste of energy.

Passing on to other problems, it is stated that in the medicinal products industry the following 3 fundamental points must be considered; (*a*) cultivation of the plants; (*b*) rational harvesting of same; (*c*) exact scientific determination of the active principle they contain. These 3 aspects of the problem should be considered simultaneously, as they are closely bound up with each other, and neglect of any one will involve failure. The 1st and 3rd points of the problem are gone into in detail, the necessity being shown for a systematic study of the distribution of wild medicinal plants, and it is maintained that the theory of " physiological characteristics " (1) will allow of easier solution of the problem of selecting the medicinal and perfume plants. On the ground that kindred plants secrete the same chemical compounds, this theory maintains that in kindred species the same ferment organs are to be found elaborating similar substances.

The closer akin the vegetable species, the greater the hope of finding similar elaborating organs and identical substances. This theory is of

(1) See this Bulletin No. 626. (*Ed.*).

great practical importance, as it affords the possibility of easily determining in what species to look for the particular medicinal substances required, and where such search would be fruitless. The theory of " physiological characteristics " introduces a new principle, according to the writer, in the doctrine of plant cultivation, systematising investigation and indicating which plants should be tested in the first place, and what wild plants may be of use through their contents of active principles.

The appended Table brings out the importance of the theory of " physiological characters ", showing that each complex vegetable substance is rarely confined to any particular species, but that in the majority of cases it occurs in several species of the same family.

In reviewing several medicinal plants demanding immediate study, mention is made of the sunflower which furnishes drops advocated as an antimalarial remedy. Investigations into this substance are urgently called for, especially as the medicinal principle of this plant must be different from that of quinine.

Finally, the need is pointed out for some kind of revision of the general ideas and suggestions of popular medicine in which medicinal plants are extensively used.

HORTICULTURE

652 - **How to obtain an Early and Abundant Crop of Tomatoes.** — BASSI E., in *Giornale di Agricoltura della Domenica*, Year XXVI, No. 16, p. 126, 2 figs. Piacenza, April 16, 1916.

The following method is advised : Sow in a hot bed at the end of January or the beginning of February ; in March when the third leaf has sprouted, replant under glass frame, at 2 × 2 inches apart ; early in April transplant again into small pots 3 to 4 inches in diameter, 1 plant in each pot, and put them in a frame with a southern aspect, the glass roof of which is closed and covered with matting during the night. Towards the end of April or the beginning of May, plants about 12 inches high are planted out in the open field. It is of great importance that the first topping should be at a suitable time (in many cases while the plants are still in pots), and that all the buds developing in the leaf axil should be cut away ; to each bunch 3 of the young fruits first developed should at first be left, and afterwards not more than 5 or 6. By this method, with careful manuring and antifungus treatment, ripening is hastened by 12 to 15 days, and a finer and larger crop obtained.

FORESTRY

653 - **Composition of Fallen Leaves of Forest Trees and Their Quantities.** — MORIYA SHIGEMASA (Chemist of Forest Experiment Station) in *Extracts from the Bulletin of The Forest Experiment Station*, Meguro, Tokyo, pp. 28-33. Tokyo, 1915.

In many localities fallen leaves are collected and used either as fuel or for other purposes. The country people generally consider only how to use these waste products for their own profit. Such a time-honoured usage should, however, be discredited, since from the standpoint of forest economy, the fallen leaves form the principal source of nutrients for the growing trees and also exert a beneficial effect by retaining water and protecting the excessive evaporation of moisture from soil.

Leaves of a number of species grown at the Experiment Station were collected and analysed, the results being given in Table I.

TABLE I. — *Composition of Fallen Leaves of Forest Trees.*

| Of 100 parts of air-dried substance | Leaves | | | | | |
|---|---|---|---|---|---|---|
| | *Criptomeria japonica* | *Pinus densiflora* | *Pinus thunbergii* | *Quercus serrata* | *Quercus glandulifera* | *Quercus vibrayana* |
| Water | 11.264 | 10.005 | 11.340 | 10.030 | 12.316 | 9.900 |
| Organic matter | 82.636 | 87.915 | 86.394 | 86.420 | 80.014 | 80.974 |
| Nitrogen | 0.972 | 0.886 | 0.855 | 1.116 | 0.945 | 1.001 |
| Ash | 6.100 | 2.080 | 2.276 | 3.550 | 6.870 | 9.126 |
| $P_2O_5$ | 0.257 | 0.163 | 0.174 | 0.165 | 0.134 | 0.210 |
| $K_2O$ | 0.340 | 0.132 | 0.124 | 0.280 | 0.297 | 0.489 |
| $Na_2O$ | 0.125 | 0.053 | 0.040 | 0.093 | 0.149 | 0.163 |
| CaO | 2.999 | 0.836 | 0.867 | 1.261 | 1.814 | 1.908 |
| MgO | 0.509 | 0.189 | 0.172 | 0.417 | 0.418 | 0.456 |
| $SO_3$ | 0.082 | 0.053 | 0.055 | 0.088 | 0.095 | 0.126 |
| $Fe_2O_3$ | 0.149 | 0.029 | 0.032 | 0.059 | 0.102 | 0.227 |
| $Al_2O_5$ | 0.448 | 0.182 | 0.194 | 0.237 | 0.315 | 0.811 |
| $SiO_2$ | 0.747 | 0.356 | 0.591 | 0.764 | 3.293 | 4.709 |

The results of the researches in the years 1911 and 1912 into the quantities of the principal ingredients found in fallen leaves per acre based on the weight of air-dried leaves are given in Table II.

TABLE II — *Weight of Principal Ingredients in Fallen leaves (per acre).*

| Ingredients | Kuromatsu Forests | Kunungi Forests |
|---|---|---|
| | lbs. per acre | lbs. per acre |
| Nitrogen (N) | 29.6 | 36.0 |
| Phosphoric acid ($P_2O_5$) | 6.1 | 5.4 |
| Potash ($K_2O$) | 4.3 | 9.0 |
| Lime (CaO) | 30.1 | 40.6 |

Table III gives the composition of rotten leaves.

TABLE III — *Composition of Rotten Leaves.*

| Of 100 parts of air-dried substance | Akamatsu | Kunugi |
|---|---|---|
| Water | 15.775 | 13.839 |
| Dry Matter | 84.225 | 86.161 |
| N | 1.401 | 1.548 |
| Ash | 27.968 | 17.604 |
| $P_2O_5$ | 1.048 | 0.166 |
| $K_2O$ | 0.277 | 0.178 |
| $Na_2O$ | 0.214 | 0.157 |
| CaO | 3.120 | 1.225 |
| MgO | 1.182 | 0.922 |
| $SO_3$ | 0.430 | 0.156 |
| $Fe_2O_3$ | 0.716 | 0.922 |
| $Al_2O_3$ | 6.980 | 3.859 |
| Sand and $SiO_2$ | 13.816 | 9.979 |

Finally, Table IV gives a comparison of the soils of wooded lands with those of the Station nursey.

TABLE IV. — *Composition of the Soils of Wooded Areas and those of Station Nursery Compared.*

| Air-dried fine soil (100 parts) | Wood lot *Cryptomeria japonica* | Wood lot *Pinus densiflora* | Wood lot *Quercus serrata* | Nursery lot |
|---|---|---|---|---|
| Water | 10.670 | 10.770 | 10.990 | 10.457 |
| Loss on ignition | 25.684 | 24.713 | 28.206 | 20.850 |
| Total Nitrogen | 0.922 | 0,878 | 0.918 | 0.327 |
| Insoluble residue in HCl | 49.184 | 54.898 | 51.830 | 49.332 |
| Silica soluble in HCl | 0.705 | 0.232 | 0.675 | 0.722 |
| Alumina | 7.983 | 7.108 | 14.400 | 12.827 |
| Oxide of iron | 7.985 | 4.580 | 5.800 | 10.569 |
| Lime | 0,820 | 2.340 | 0.490 | 0.746 |
| Magnesia | 2.931 | 1.327 | 1.943 | 1,729 |
| Potash | 0.155 | 0.217 | 0.213 | 0.026 |
| Soda | 0.246 | 0,324 | 0.252 | 0,365 |
| Phosphoric acid | 0.423 | 0.305 | 0.214 | 0.069 |
| Sulphuric acid | 0.284 | 0.209 | 0.332 | 0.183 |

A close study of the above table shows that the soils of these three wooded lands are quite different in composition. This is chiefly due to the difference of tree species, the age and closeness of the stands as well as to other forest conditions. One point common to the three lots is the richness in nitrogen, phosphoric acid, potash and lime, the lots being thus fertile as compared with the soil of the nursery bed of the Station.

The above statements will make it evident that the richness of the soil of a wood is dependent upon fallen leaves which greatly enrich originally poor soil or the land left waste for the lack of fertility. Such land will of course be considerably improved by the planting of trees thereon.

654 - **Investigation of Tree Seeds in Relation to the Place of Origin of the Parent Trees and Their Descent.; and Experiments on the Preservation of the Principal Forest Tree Seeds.** — I. SHIRASAWA, H. *Extracts from the Bulletin of the Forest Experiment Station, Meguro, Tokyo*, pp. 1-14. Tokyo, 1915. II. SHIRASAWA H. and KOYAMA, *Ibid*, pp. 15-27.

I. Research on Japanese seeds, extending over a period of 10 years from 1902 as the Japanese section of the general investigation organised by the International Association of Forest Experiment Stations. The tree species used in the experiments were *Cryptomeria japonica* Don. (Sugi), *Pinus densiflora* Sieb. et Zucc. (Akamatsu) and *Pinus thunbergii* Parl. (Kuromatsu).

The following conclusions may be drawn from the results given :

1) Seeds obtained from a young seed-tree (20-30 years old) are large and seedlings grown from such seeds show a better growth ;

2) Seedlings from the seeds produced in localities warmer than that of the nursery, will grow better than those obtained from colder districts, so that it is always advisable to bring seeds from warmer places ; if there is fear of frost, care should be taken to protect well against it, since the seeds from warmer localities continue their vegetation later in the fall, so that new buds coming late may suffer from an early frost and perish in winter ;

3) Forest trees grown from seedlings originating in warmer districts than the nursery, bear many flowers and fruits in their early years ; trees grown from the seeds of a climate colder than that of the nursery bear few flowers and fruits and are very slow in growth ;

As to the influence of the age of the seed-tree, old trees give rise to a smaller number of fertile seeds capable of producing saplings, but which are of slower growth. This is particularly true in the case of *Cryptomeria japonica ;* but in the case of *Pinus densiflora* and *P. thunbergii*, the difference is hardly recognisable.

For the reasons above stated, the best tree seeds should be taken from a young seed-tree grown in a locality similar in climate to the place where the seeds are to be sown. (1)

II. The persistence of the germinating power of forest tree seeds varies according to species, and is influenced by the conditions under which the seeds are kept. Of the seeds tried, *Pinus thunbergii* Parls and *Pinus densiflora*

(1) See *B.* July, 1915, No 718. (*Ed*).

Sieb. et Zucc. keep their germinating power best, being followed by *Lari leptolepsis* Gord., *Cryptomeria japonica* Don. and *Cinnamomum camphor* Nees. in order, while *Chamaecyparis obtusa* Sieb. et Zucc. loses its germinat ing power the soonest.

The seeds of every species tried and of other similar trees are best store in air-tight vessels at as low a temperature as possible. *Chamaecyparis obtus* seeds should be stored in a temperature lower than 10° C. at the highest No artificial drying of seeds is necessary previous to storing.

The best place for storing seeds is a cellar so made that the tempera ture is uniform, for which purpose in Tokyo it is necessay to dig 8-10 me tres below the surface. The so-called " wind holes " where the peopl store silk worm eggs found in the mountains would serve well for storin of tree seeds.

655 – **The *Genus Juniperus* and Its Commercial Importance.** — DELLIMORE W *Royal Botanic Garden Kew, Bulletin of Miscellaneous Information*, N° 1, pp. 16-23 London, 1916.

The genus *Juniperus* includes many species of trees and shrubs widely distributed in the northern hemisphere and occurring south of the Equator in the mountains of Eastern Tropical Africa. They are found throughout Europe, in Asia Minor, Asia from the Himalayas northwards almost to the limit of shrub life, North America, the West Indies, Northern Africa, East Africa, the Canary Islands and the Azores. They are often of slow growth, and it is doubtful whether any species planted under forest conditions in the British Isles would prove a financial success. In many instances the wood is red or yellow in colour and fragrant. It is sometimes used for building purposes and for cabinets, but its most important use is for the casings of lead pencils, no other kind of wood having been found so suitable for this purpose as the better grades of juniper. When too small or knotty for other uses, it forms very serviceable fences. Oil, used for perfumery etc. is obtained from the wood by distillation and may also be procured from the leaves and fruits of certain species. Medicinal properties of a diuretic character are possessed by the junipers. The following species are of economic importance :

*J. barbadensis* Linn. (Barbados Cedar, Southern Red Cedar). It is found in the West Indies and in the Southern United States, where it often grows in swamps near coastal rivers, and under the best conditions attains a height of 50 ft. with a girth of 6 ft., its average size being 30 ft. The wood is popular for pencil making.

*J. bermudiana* Linn. (Bermuda Cedar, Bermuda Red Cedar). It is found in Bermuda, where it grows under a variety of conditions, both in brackish swamps and on limestone hills. Average-sized trees are 40-50 ft. high. The wood is valuable for ship-building and for furniture.

*J. californica* Carr. (White Cedar, Sweet berried Cedar, Californian Juniper). A bush or small tree found wild in California, Arizona etc. The wood is used for fence posts.

*J. cedrus* Webb. and Berth (Canary Islands Juniper, Canary Islands Cedar, Sabina Tree). It is native of the Canary Islands, where it ascends the

mountains to a height of 7 000-9 000 ft., sometimes attaining a large size. Dr. G. V. PEREZ, of Teneriffe, considers it might be planted with advantage under forest conditions for its timber.

*J. chinensis* Linn. (Chinese Juniper). — It is quite hardy in the British Isles, and is largely grown as a decorative tree or bush. The wood is durable and useful for many purposes, but is not obtainable in quantity and is of no importance in the timber market.

*J. communis* Linn. (Common Juniper, Ground Cedar). — Widely distributed through Europe, Northern Asia and North America. In some Continental countries it attains a height of 30-40 ft. The wood is used for fencing, for milk pails and other domestic articles, and for walking-sticks. The oil is used for medicinal and for flavouring purposes. The fruits have been of commercial importance (for use in the distilleries) for a long period.

*J. drupacea* Labil. (Drupe-fruited Juniper, Syrian Juniper). — Native of Asia Minor and Syria, where it often grows 60 ft. high. Although the timber is reputed to be of good quality, the consumption is apparently quite local.

*J. excelsa* Bieb (Grecian Juniper). — Widely distributed from the Balkans through South-East Europe to Asia Minor and Syria. In Asia Minor attains the maximum size: 70-100 ft. height and 4 ft. in diameter of the trunk. The timber is reputed to be of good quality and has been recommended for railway sleepers.

*J. formosana* Hayata (Prickly Cypress). — A species spread over a considerable area in China and also found in the mountains of Formosa. It was introduced in the British Isles about the middle of last century, but is rare in cultivation. The timber only appears to be used locally.

*J. macrocarpa* Sibth. (Large-berried Juniper). — Found as a bush or a small tree throughout Southern Europe and in some parts of North Africa. The fragrant wood appears to be used with that of *J. oxycedrus* for distillation.

*J. macropoda* Boiss. (Himalayan Pencil Cedar). — Widely distributed from Nepal to Afghanistan, often from 40-50 ft. high with a trunk 6-7 ft. in girth, but sometimes much larger. The wood is fragrant and moderately hard; it is used for wall-plates, beams and fuel. A closely allied tree from the same region is *J. religiosa.*

*J. mexicana* Schiede (Rock Cedar, Juniper Cedar, Mountain Cedar, Cedar). — This species forms forests on the limestone hills of Mexico and Texas where it sometimes reaches 95 ft. high. The wood is used for general construction, fencing, sills, telegraph poles, railroad ties and fuels.

*J. occidentalis* Hook. — (Canadian Juniper, Californian Juniper, Western Red Cedar, Yellow Cedar). — Widely distributed in North West America from Canada to California. The wood is used for fencing as it lasts well in contact with the soil.

*J. oxycedrus* Linn. (Sharp Cedar, Brown-berried Juniper). — Common throughout the Mediterranean region from sea level up to 5000-6000 ft., usually as a shrub but sometimes as a small tree. In Italy, it occupies con-

siderable areas on sand dunes. The principal use of the wood is for distillation (« oil of cade »).

*J. pachyphlaea* Torr. (Oak-barked Cedar, Thick-barked Cedar, Mountain Cedar, Chequer-barked Juniper). — Found wild in the dry regions of Texas, New Mexico, and Arizona.

*J. phoenicea* Linn. (Phoenician Juniper). — An important tree in the Mediterranean region ; its timber is used for building purposes and for firewood. It varies in height from little more than a shrub to a tree of 40 ft.

*J. procera* Hochst (East African Juniper or Cedar). — Found wild on the mountains of East-Africa. The wood, of light weight and nearly as soft as red cedar, is a likely substitute for that of *J. virginiana* for pencil making.

*J. recurva* Buch-Ham. — A tree, native of Eastern Himalaya. The wood is quite equal to the best pencil cedar, but is only used for burning as incense in the Buddhist temples. *J. squamata* from the Western Himalayas, China and Formosa is a closely allied species with very similar wood.

*J. rigida* Sieb. et Zucc. — A shrub or small tree native of Japan. The wood has good lasting properties and is put to many local uses.

*J. sabina* Linn. (Savin). — A shrub or bush distributed through Central and Southern Europe, the Caucasus, North Persia and North America. The wood is of little value except for walking sticks and firewood ; from the shoots and leaves is extracted a medicinal oil (savin oil).

*J. scopulorum* Sarg. (Red Cedar, Rocky Mountain Red Cedar). — A small tree, native of the Rocky Mountains. The wood is useful for fencing, posts etc.

*J. thurifera* Linn. (Spanish Juniper, Incense Juniper). — A tree distributed through Spain, Portugal, Algeria and Morocco. The wood does not appear to be used other than locally, although it is of good appearance and possesses good lasting qualities.

*J. virginiana* Linn. (Cedar, Pencil Cedar, Red Cedar, Virginian Cedar). This species is very widely distributed in North America, and is the most satisfactory of the large growing junipers in the British Isles. It varies from a bush to a tree 120 ft. high with a diameter of 3 ft. A very valuable species from a commercial standpoint. Its wood is used more often than that of any other kind for the casings of lead pencils. Knotty wood, unsuitable for pencil-making, is very useful for fences, railway sleepers, etc. The shavings and dust from pencil factories is distilled for the fragrant oil, which is used in perfumery. The shavings after distillation make an excellent substitute for coconut fibre as a plunging material for horticultural purposes, as fungi do not grow upon them.

*J. Wallichiana* Hook f. (Black Juniper). — A variable species in the Himalaya. The wood appears to be used locally for building purposes.

656 - **The Proper Season for Application of Fertilizers to *Cryptomeria japonica* and *Chamaecyparis obtusa* and the Efficacy of the Former.** — MORIYA S. *Extracts from the Bulletin of the Forest Experiment station, Meguro, Tokyo*, pp. 34-41 Tokyo, 1915.

The results of trials to establish the best time for the application of the 4 principal nitrogenous manures (ammonium sulphate, Chili saltpetre, rapeseed cake, night soil), together with a sufficient amount of potash and phosphoric acid as sodium phosphate and potassium phosphate, to *Cryptomeria japonica* Don. (Sugi) and *Chamaecyparis obtusa* Sieb. et Zucc. (Hinoki). Seedlings grown on the loamy soil, rich in humus, of the nursery in the Forest Experiment Station lead to the following conclusions:

1) The above-mentioned manures are less efficient even though used several times, unless they are applied at the proper season;

2) The efficacy of base manures was especially noted both for *Cryptomeria japonica* and *Chamaecyparis obtusa*; this is partly due to the fact that the manure so applied is accessible for the seedlings from the beginning, and partly to the perfect mixing of the manure with the soil so that the tender rootlets of the young plants can take the nutrient in the soil; the most suitable base manure both for *Cryptomeria japonica* and *Chamaecyparis obtusa* is sulphate of ammonia, nitrate of soda, rape-seed cake, where $1/3$ of the entire quantity is given as base manure in a few days previous to the planting of seedlings, while the rest is given as top-dressings in two times, viz., in the middle of September and early in May, next year;

3) With night soil, the best result was obtained when the entire quantity was given previous to the planting;

4) With *Cryptomeria japonica* a second good result was obtained with sulphate of ammonia, rape-seed cake, and night soil, where one-half of the entire quantity was given at first as base manure while the rest was given at four times, viz., at first as base manure, beginning of June, middle of September and early in June, next year;

5) As to *Chamaecyparis obtusa*, the second good result was obtained with all manures given $1/4$ as base manure and $3/4$ as 3 top-dressings, though this lot showed a medium result with *Cryptomeria japonica*; with all the rapeseed cake given previous to planting, the most disappointing result were showed for both species of tree.

6) Methods other than those above described, proved more or less inferior; further, the action of fertilizers was more noticeable for *Cryptomeria japonica* than *Chamaecyparis obtusa* as its growth is far quicker; among the manures applied, sulphate of ammonia showed the best result for both trees, and rapeseed cake the worst; with *Cryptomeria japonica* night soil showed better results than nitrate of soda, but it was just the opposite in the case of *Chamaecyparis obtusa*.

657 - **Value of Eucalyptus Wood as Fuel: Experiments in the State of San Paulo, Brazil.** — DE ULHOA CINTRA JAYME, in *O Fazendeiro*. Year VIII, No. 10, pp. 301-303, 1 fig. San Paulo, October 1915.

In order to ascertain whether the wood of the different varieties of *Eucalyptus* possesses any industrial value as a fuel, the railway Company

of the State of San Paulo, where the above writer is chief of Rolling Stock made trials with wood of 10-year old trees from the "Horto Florestal" at Jundiahy, using it on engines running on the Jundiahy-Campinas line for comparison with the wood usually burnt by this Company. The consumption per 1000 metric tons and per kilometer was as follows :

| | | |
|---|---|---|
| Ordinary wood selected | 15.89 | cubic feet. |
| *Eucalyptus rostrata* | 15.19 | " |
| *E. tereticornis* | 21.29 | " |
| *E. longifolia* | 15.00 | " |
| *E. botryoides* | 21.29 | " |
| *E. obtusa* | 16.25 | " |

Therefore the different kinds of wood tried were found to possess a practically equal value, slightly higher in well selected seasoned ordinary wood, and in the wood of *Eucalyptus rostrata*. The latter and that of *E. tereticornis* are equal or superior to the best hard woods ; they burn with a short flame and last a long time. *E. longifolia*, *E. botryoides* and *E. robusta* also yield woods which are hard, though a little less so than the above named : they are excellent for passenger trains.

658 — **Commercial Development of Forests in British India.** — *Quinquennial Review of Forest Administration in British India for the period* 1909-10 *to* 1913-14, *to which is appended the Annual Return of Forest Statistics for the Year* 1913-14, pp. 31 (8-9) 2 dgms. 2 maps, Simla, 1915.

The quinquennial review of the Forest administration in India contains a summary of the progress that is being made in the development of the Indian forests, which cover no less than 250 000 sq. miles (1). As regards the commercial development of the forests in British India, the report shows that an encouraging advance has been made.

In recent years there has been a noticeable increase in the demand for forest products, and several industries dependent on their supply have been or are about to be started. One of the most important of these is the utilization of bamboos, savannah grasses and firwood for the manufacture of paper-pulp, and to assist the development of this industry a special expert has been employed. With the assistance of the Titaghur Paper Mills Company, Limited, trials in the manufacture of bamboo pulp have been carried out successfully on a commercial scale, and concessions for the extraction of bamboos have been granted to two firms in Burma and Bengal. The outbreak of war has delayed the commencement of manufacture but as large supplies of the raw material are available the outlook is distinctly promising. In the Punjab, a concession for the extraction of spruce and silver fir from the Kulu forests for the manufacture of wood pulp has been granted. Matters are less advanced as regards the grass pulp industry, but this is being seriously considered. In the United Provinces and Assam, enormous quantities of suitable grasses are available

(1) See *B.* May 1912, No. 807 ; *B.* Feb. 1915, N° 195. (*Ed*).

and if trials on a commercial scale are successful, an important industry may be established.

The extraction of tanning materials has received attention for some time past, particularly in the matter of obtaining a satisfactory extract from the bark of mangroves. For this purpose a factory was established several years ago at Rangoon, but owing to the want of expert supervision was not very successful. In order to test the possibility of producing extracts of good quality on a commercial scale, the services of a tannin expert have been obtained. The forests of India contain many valuable tanning materials other than mangrove bark. The possibility of utilising these will be examined by the expert, and his appointment may result in the establishment of a new and important industry.

During recent years much has been done to stimulate the local manufacture of matches; tests with numerous Indian woods have been carried out and a report regarding their suitability and the prospects of this industry has been issued. Several match factories on modern lines have been established, and if a sufficient supply of match woods of good quality can be assured, there is no reason why the industry should not grow rapidly. The regular and cheap supply of suitable wood is, however, a real difficulty, and the establishment of special plantations is a matter deserving the attention of local Governments.

The tea-box industry has received special attention in Assam, where it absorbs a considerable portion of the output of the forests, and has steadily grown, especially in the Assam Valley. The Local Administration has fostered the industry by remissions of royalty on tea-box wood, by devising measures for the protection of timbers used for tea-boxes, and by forming experimental plantations of « simal » (1).

Large quantities of sleepers have always been obtained by the Indian railways from the forests in India, but as the supply of first class sleeper woods such as « sâl » (2) and deodar is limited, experiments in the antiseptic treatment of less durable timbers have been in progress for some years past. The Indian forests contain many timbers which, so far as structural qualities are concerned, are at least the equal of imported sleeper woods, and these, if treated antiseptically, should go far to meet the demands of the Indian railways. The best and most economical method of treatment has not yet been determined, but experiments are being carried out. Arrangements, however, have already been made with the Railway Board for the delivery of a large number of treated « chir » pine (3) sleepers from the forests of the United Provinces while a similar supply of « gurjan » (4) sleepers from the Andamans is under consideration.

Another important forest industry in which, under departmental

(1) *Bombax malabaricum* DC. (BRANDIS, D. *Indian Trees*, p. 77. London 1907).
(2) *Phoreau robusta* Gaertn (*Ibid*).
(3) *Pinus longifolia* Rox b. (*Ibid*).
(4) « Gurjun », *Dipterocarpus turbinatus Gaertn.* (*Ibid*). (*Ed*).

management, marked progress has been made, is the manufacture of rosin and turpentine from crude resin obtained by tapping pine trees in the Himalayan forests. In the Punjab and the United Provinces, new distilleries have been erected and in 1913-14 these turned out 27 429 maunds of rosin and 58 803 gallons of turpentine compared with 6 584 maunds of rosin and 14 603 gallons of turpentine ten years earlier. The Indian demand for these products, which are largely used in the manufacture of paper, paints and varnishes, is considerable, and the local output has already affected imports from other countries. In the Punjab, a modern plant has been erected near Lahore and a large increase in the output is also expected in the United Provinces. It is not too much to expect that a considerable portion of the Indian demand for rosin and turpentine will soon be met by the Department.

This account of the improved methods of extraction now adopted and of the new industries which have been started, is sufficient evidence that the officers of the Forest Department are fully alive to the importance of the commercial development of the Indian forests and that they now recognise that efforts to secure commercial success are as much a part of their duties as the scientific management of the forest property entrusted to their care.

## LIVE STOCK AND BREEDING.

HYGIENE

659 – **"Emphysarcol" (*Emphysarcolum siccum* Foth), a new Vaccine for the Treatment of Symptomatic Anthrax.** — Foth H., in *Berliner Tierärztliche Wochenschrift*, 32nd Year, No. 11, pp. 121-123. Berlin, March 16 1916.

The Author, in 1911, published results of experiments carried out under the anspices of the Prussian Ministry of Agriculture with the object of obtaining an effective vaccine against symptomatic anthrax. He had prepared a specific anti-infection serum for cattle, and a vaccine (*Emphysarcolum siccum*) prepared from pure cultures of the anthrax bacillus.

The experiments have since been continued. The preparations of the serum, however, was given up on account of the expense, though it gave good results with simultaneous injections. On the other hand, excellent results were secured with the vaccine prepared from pure cultures of the anthrax bacillus, which the Author calls "Emphysarcol". It is a yellowish-white powder composed of : albumens soluble in water, dead bacilli of symptomatic anthrax, living spores of anthrax, and products of metabolism of the spores. This vaccine is prepared with 2 types of spores which differ in virulence. Type A is very virulent and rich in spores, and requires to be toned down ; type F, less virulent, almost free from spores, does not require to be weakened.

The preparation of the vaccine is perfectly easy for anyone with bacteriological experience.

The vaccine is tested on guinea-pigs, and afterwards injected into the

cattle subcutaneously, using half of the dose required to kill a guinea-pig weighing 9 oz.

The vaccine which the Ministry recommends has been on the market since 1915. All veterinary surgeons who have tested it have reported favourably upon it.

660 – **Test with Salvarsan in the Treatment of Glanders; its Influence on the Formation of Antibodies in the Blood of Horses.** — WIESSNER and LANGE, in *Deutsche Tierarztliche Wochenschrift*, 24th Year, No. 14, pp. 127-130. Hanover, April 1st 1916.

The Authors tested the efficacy of salvarsan and neosalvarsan in the treatment of glanders in 8 horses. In order to obviate risk of failure due to an advanced stage of the disease, they made use of animals having no apparent symptom of glanders, but the examination of whose blood suggested its presence. With all the subjects, the blood was examined both before and after the injection of salvarsan so as to ascertain at the same time the influence of the drug on the formation of antibodies in the blood. A few weeks afterwards the horses were killed and the pathological changes in their organs were examined.

The post-mortem showed that 2 of them were quite healthy, while in 5 there were fresh pathological changes and in the remaining animal these changes had reached an advanced stage. As the 2 healthy horses showed no pathological change, not even one subsequently cured, it is held that they never suffered from glanders, thus precluding any curative action of the preparation tested. On the other 5 horses salvarsan had no effect, as evidenced by the fact that after the treatment pathological changes occurred. In one case alone the disease was stopped after the injection, but not necessarily by the injection itself, as it is known that the changes may lapse into a latent stage without treatment of the animals. The general conclusion is that it is impossible to cure glanders with salvarsan or neosalvarsan.

The examination of the blood before and after injection of the drug, with a view to ascertaining the influence of salvarsan on the formation of antibodies, is still doubtful in its result. By employing the agglutination method, however, there was observed a reduction of the antibodies in all the sick horses shortly after the injection, and some time later, an increase. Probably, therefore, the injection of salvarsan or neosalvarsan allows of detecting whether or not a horse is suffering from glanders.

661 – **The Virulence of the Blood of Animals Suffering from Epizootic Foot-and-Mouth Disease.** — COSCO GIUSEPPE and AGUZZI ANGELO, in *La Clinica veterinaria*, Year XXXIX, No. 7, pp. 193-195. Milan, April 15, 1916.

The General Direction of Public Health in Italy has instituted a series of experimental investigations into epizootic foot-and-mouth disease, by a number of investigators. The above article contains a summary of the experiments on the prophylaxis of the disease conducted at the " R. Cascina " (Royal Farm) of Poggio at Caiano (Florence) comprised in this group of investigations. Up to now 116 cattle have been subjected to test, with the following results :

1) The blood of animals infected with foot-and-mouth disease is virulent during the entire febrile stage. The virulence is of high degree, not inferior to that of the products of the characteristic eruptions of the disease.

2) The red corpuscles and the serum of the blood of the infected animals, inoculated separately into cattle, are also virulent.

3) The defibrinised blood of these animals, kept in a refrigerator retains its virulence for a long time (more than one month). This virulence of the red corpuscles lasted longer than that of the blood serum

4) The red corpuscles, repeatedly washed in large quantities of sterilised physiological solution, in order to remove any trace of serum, and afterwards inoculated into the cattle hypodermically, even in a dose of 1 cc., communicated the infection. Injection of the same dose of serum is also capable of communicating foot-and-mouth disease to cattle.

5) Inoculation of the infected blood into cattle in series enhances its virulence.

6) No onset of the disease appears to follow infection of the cattle through the ordinary channel (the mouth) when the washed red corpuscles are used as the infecting material.

The red corpuscles, which therefore possess a virulence lasting some time, provide: 1) a highly pure infective material which can be kept more than one month; 2) a homogeneous cellular mass containing the virus in the pure state, which may really be regarded as a culture of the pathogenic agent, and can be subjected to certain operations used in preparing vaccines, which are very difficult or impossible with the highly impure products of the local eruptions and their filtrates.

ANATOMY AND PHYSIOLOGY: GENERALITIES.

662 - **Experimental Studies of Castration: its Effects on Oxygen Exchange of the Tissues.** — AGNOLETTI GIUSEPPE, in *La Clinica veterinaria*, Year XXXIX, No. 7, pp. 195-199. Milan, April 15, 1916.

The results of these investigations, carried out at the Laboratory for Experimental Physiology in the Higher Veterinary School of Milan, Italy, may be summarised as follows:

The tissues of young castrated animals produce a quantity of carbonic acid markedly below that of entire animals; the former also consumed less oxygen than the latter. The difference was more pronounced in the liver than in the muscles, that being the organ which was most affected by the castration, and which showed the largest reduction in elimination of carbonic acid gas and absorption of oxygen. It may be assumed that the tendency to fatten in castrated animals is related to this large reduction in the oxygen exchange of the liver.

FEEDS AND FEEDING

663 - **Investigations into Nutritional Deficiency** (1). — I. WEILL E., MOURIQUAND G. and MICHEL P., in *Comptes Rendus de Séances de la Société de Biologie*, Vol. LXXIX, No. 5, pp. 189-193. — II. WEILL E. and MOURIQUAND G., *Ibid*, pp. 194-199. Paris, March 4, 1916.

I. — In a previous series of notes Messrs. WEIL and MOURIQUAND demonstrated that the sterilisation of grain (barley) caused nutritional de-

(1) See *B.* April, 1915, No. 475. (*Ed.*)

ficiency troubles in pigeons identical with those produced by husking. In order to ascertain whether the sterilisation of meat can produce derangements of a similar kind in mammals, experiments were carried out with cats fed exclusively on meat, raw and fresh, frozen, recently salted, cooked, freshly sterilised and old. The results prove that it is possible, with cats fed exclusively on sterilised meat, to produce nervous disorders (paraplectic, convulsive or cerebellar) closely approaching, if not identical with, those occasioned in pigeons by the sterilisation or husking of cereals. The ageing of the sterilised meat appears to hasten the moment of onset of the disorders. The whole is entirely consistent with the view that sterilisation deprives meat, just as it deprives grain, of the "ferment substance" necessary for nutrition, especially of the nervous system.

II. — After having ascertained that the localisation of the "ferment substances" in grains is chiefly cuticular, the question arose whether raw husked cereals did not themselves, though in lesser quantities (incapable of averting nutrition troubles for any length of time) contain these same substances or a combination of "living" substances able to retard the appearance of the pathological symptoms. In order to solve this question a comparison was made on 4 lots of pigeons between the effect of feeding exclusively with a raw husked cereal (barley or rice) and that of exclusive feeding with the same husked cereal sterilised at 120° C. for 1 ½ hours. The results showed that sterilisation deprived the husked grain of a residue of "ferment substances" which it had not been possible to detect in the previous investigations.

These facts have a practical application : The flour of husked cereals gives rise to nutritional deficiency trouble in the child and the adult (scurvy and beri-beri). Its sterilisation, by removing the little amount of "ferment substance" which remains, seems likely to increase the danger attending its consumption. As regards the sterilisation of milk, especially when intended for children, the writer does not prohibit it, but advises that it should not be excessively prolonged, or else that a small quantity of orange juice be added to the sterilised milk.

664 - **Trade in Concentrated Foods for Livestock in Uruguay.** — (From a *Communication* of the "*Ministerio de Industrias, Oficina de Estadística y Publicaciones*", Montevideo) (1).

As a result of the enquiry of the International Institute of Agriculture into the trade in concentrated foods for livestock in different countries, the "*Inspección nacional de ganadería y agricultura*" (Livestock and Agriculture Inspection Office) and the "*Inspección de policía sanitaria animal*" (Health Office for Livestock) in Uruguay gathered the data existing in relation to that country.

*Production.* — That of linseed cakes is sufficiently extensive, owing to the amount of flax-growing for seed ; the production may be estimated at 6198 tons for the period 1904-1913. The production of earth-nut and

(1) See : INTERNATIONAL INSTITUTE OF AGRICULTURE, BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES, *The International Trade in Feeding Stuffs*, Nos. 1 and 2. Rome, 1915 and 1916. (*Ed.*).

rape cakes (406 tons for the same period) is less developed. Beetroot pulp, produced in the sugar mill in the department of Maldonado is utilised by that mill for its draught oxen ; the molasses are sold for the manufacture of alcohol. Furthermore, the by-products of two big breweries in Montevideo are used on the spot, being given wet to cows and dry to horses. One of the principal products of Uruguay, as a concentrated food for livestock, is meat meal, of which Liebig's Meat Extract Company at Fray Bentos turned out, from 1904-1914, the quantities indicated in Table I.

TABLE I. — *Quantities of Meat Meal produced by Liebig's Meat Extract Company from* 1904 *to* 1914.

| Seasons | Tons | Seasons | Tons |
|---|---|---|---|
| 1904-1905 | 3 324.4 | 1910-1911 | 1 475.2 |
| 1905-1906 | 4 228.6 | 1911-1912 | 1 929.4 |
| 1906-1907 | 2 168.2 | 1912-1913 | 1 521 |
| 1907-1908 | 2 220.9 | 1913-1914 | 1 115.6 |
| 1908-1909 | 2 076.7 | | |
| 1909-1910 | 2 582.7 | Total | 23 092.7 |

The following is the chemical composition of Liebig's meat meal : Water, 11.70 %, Ammoniacal Nitrogen 13.98 %, Fats, 12.25 %, Mineral substances, 2.08 %. On the other hand, the " Frigorifico Montevideo " from its foundation till 1904, produced 1016 tons of meat meal .

*Exportation.* Uruguay exports concentrated food for cattle and live-stock generally, as shown by the following particulars :

TABLE II. — *Export of Bran and Milling Offals from Uruguay.*

| Years | Bran | Offals |
|---|---|---|
| 1901-05 | 3 100 tons | 979 tons |
| 1906-09 | 2 600 | 2 108 |
| 1910 | 1 740 | 1 476 |
| 1911 | 903 | 1 000 |
| 1912 | 9 125 | 3 153 |

The meat meal referred to above is almost wholly exported to the following countries: Germany, Belgium, United Kingdom, United States.

*Consumption.* Owing to the extensive character of livestock production, due particularly to the natural grass-lands, and also in part to forage cultivation, concentrated feeds are not consumed in Uruguay in any appreciable quantity, except for stabled animals and partly in the dairy industry (in which cases brewers' residues, linseed oil and maize cakes are used to fatten up show animals, or, still more frequently, bran and milling offals, especially if the pasturage in winter is not sufficient for the dairy cattle). Nevertheless, according to the investigations of Prof. SCHROEDER (1)

(1) See : *Biblio ,raphy*, in *The International Trade in Feedin; Stuffs* quoted above.

TABLE III. — *Exportation of Oil Cakes from Uruguay.*

| Years | Linseed | Colza | Ground nut | Rape |
|---|---|---|---|---|
| 1901-05 | 446 tons | — | 66 tons | 19 tons |
| 1906-09 | 299 | 13 tons | 18 | — |
| 1910 | 203 | 57 | — | — |
| 1911 | 507 | — | — | — |
| 1912 | 436 | — | — | — |

it will be possible in Uruguay to make use of numerous agricultural and industrial bye-products (rice flour, brewers' and maize waste, linseed, rape and ground-nut cakes), as well as dried blood and fish meal; always however with regard to the price of other cattle foods on the market.

*Prices.* The following are the prices of the 2 principal products:

*Linseed oil cakes*: £6. 14*s* - £7. 7*s*. per ton, at par.

*Meat flour*: £12. 2*s*. per ton, at par.

665 - **Horse-breeding in Italy, in 1914; Strength of Studs.** — *Bollettino del Ministero di Agricoltura, Industria e Commercio*, Year XV, Parts 11 and 12, pp. 179-207. Rome, March 11 and 18, 1916. HORSES

On the 1st January 1914, the numerical strength of the various Studs comprised 891 breeding sires, divided as follows:

| | | | |
|---|---|---|---|
| Thoroughbreds | English | 93 | 10.43 % |
| | Oriental | 107 | 18.29 |
| | Anglo-Oriental | 56 | |
| Halfbreds | | 131 | 54.67 |
| Quarterbreds | | 312 | |
| Trotters | | 45 | |
| Heavy draught horses | | 147 | 16.61 |
| Total | | 891 | 100.00 |

As regards types, there were: 256 saddle stallions, 442 saddle and light draught stallions, 45 trotters and 148 heavy draught stallions.

In the course of the year, owing to death or supersession, there was a reduction of 42 stallions. In order to replace losses, and gradually increase the number of stallions, in accordance with the Law of the 6th July 1912, No. 832, thoroughbred and halfbred stud stallions were bought within the Kingdom. In February 1914, nevertheless, there were imported from Egypt (at the total price of £2 216. 18*s*. or an average of roughly £201. 10*s*. 11 oriental stallions, the proceedings for purchase of which were in progress at the end of 1913).

For the stallions purchased in the Kingdom, the following were the prices paid:

| | Total price | Average per head |
|---|---|---|
| 7 English thoroughbreds for crossing | £ 2 797 10 s. | £ 399 10 |
| 5 Pure oriental and Anglo-oriental thoroughbreds | 785 10 s. | 157 |
| 2 French trotters | 793 10 s. | — |
| 1 American trotter | — | 119 |
| 9 Heavy draught stallions | 1 627 | 180 10 |
| 36 Crossbreds (halfbreds and quarterbreds) | 5 408 10 s. | 150 5 |
| 4 foals from the breeding depot of Latium | 349 | — |

On the 31st December 1914, the Studs comprised 924 stallions, divid as follows:

| | | | |
|---|---|---|---|
| Thoroughbred | English | 95 | 10.28 % |
| | Oriental | 114 | 18.38 |
| | Anglo-oriental | 57 | |
| Halfbreds | | 136 | 55.00 |
| Quarterbreds | | 329 | |
| Trotters | | 42 | |
| Heavy draught | | 151 | 16.34 |
| Total | | 924 | 100.00 |

As regards the mares served by the State stallions in 1914, they we divided as shown by the appended Table

*Classification of Mares served.*

| Descriptions of Stallion | Number of serving stallions | Number of mares served | Average number of mares per stallion of each description | Number of mare per stalli Genera average |
|---|---|---|---|---|
| English thoroughbreds | 90 | 3 841 | 42.67 | 50.08 |
| Oriental throughbreds | 113 | 4 710 | 41.68 | |
| Anglo-oriental throughbreds | 54 | 2 128 | 39.40 | |
| Halfbreds quarterbreds | 444 | 23 252 | 52.36 | |
| Trotters | 48 | 2 582 | 53.70 | |
| Heavy draught horses | 146 | 8 314 | 56.94 | |
| Totals | 895 | 44 827 | — | |

The stud expenses for 1914 show the following averages per stallio

| | | £ | s. | d. |
|---|---|---|---|---|
| General expenses | | 13. | 3. | 5. |
| Staff | | 50. | 19. | 8. |
| Fodder | Annual expenditure | 36. | 12. | 6. |
| | Average cost of daily ration | 0. | 2. | 0. |

CATTLE

666 – **Requirements for Advanced Registry of Cattle Breeds in the United States.**
HOARDS' DAIRYMAN, Vol. LI, No. 4, p. 145. Fort Atkinson, Wisc., February 18, 1916.

The appended Table gives the requirements for admission to the Ac vanced Registry of the 5 principal breeds: Ayrshire, Brown Swiss, Guernse Holstein-Frisian and Jersey.

| Age | Ayrshire | | Brown Swiss | | Guernsey | Holstein | | Jersey | |
|---|---|---|---|---|---|---|---|---|---|
| | Milk in 365 days | Fat in 365 days | Milk in 365 days | Fat in 365 days | Fat in 365 days | Fat in 7 days | Fat in 365 days | Fat in 7 days | Fat in 365 days |
| | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. |
| Two years . . . . . | 6 000 | 214.3 | 6 000 | 222.0 | 250.5 | 7.2 | 250.5 | 12.0 | 250.5 |
| Three years . . . . | 6 500 | 236.0 | 6 429 | 238.4 | 287.0 | 8.8 | 287.0 | 12.0 | 287.0 |
| Four years . . . . . | 7 500 | 279.0 | 7 286 | 271.3 | 323.5 | 10.4 | 323.5 | 12.0 | 323.5 |
| Five years . . . . . | 8 500 | 322.0 | 8 143 | 304.1 | 360.0 | 12.0 | 360.0 | 12.0 | 360.0 |
| Six years . . . . . | 8 500 | 322.0 | 9 000 | 337.0 | 360.0 | 12.0 | 360.0 | 12.0 | 360.0 |
| *Required Average Daily Increase:* | | | | | | | | | |
| From 2 to 3 yrs . . | 1.37 | 0.06 | — | — | — | — | — | — | — |
| From 3 to 5 yrs . . | 2.74 | 12 | — | — | — | — | — | — | — |
| From 2 to 5 yrs . . | — | — | — | — | 0.10 | — | 0.10 | — | 0.10 |
| From $2^1/_2$ to 6 yrs. | — | — | 2.35 | 0.09 | — | — | — | — | — |

The seven-day tests must constantly be supervised by an inspector, usually appointed by the State Agricultural College, and the year tests have to be authenticated by one or two days inspection each month by a similar official. All associations try to guard their registers from trickery and fraud, and have certain rules that must be complied with.

Official tests are those which are under constant supervision ; and semi-official or authenticated tests are those which are based upon official supervision for one or two days each month. All cows are subject to re-entry when their production has been properly authenticated according to the rules, and they reach the required amount for their attained age.

The requirementsf or the entry of bulls in the Advanced Register are :

*Ayrshire :* All bulls having 4 daughters in the Advanced Registry, from different dams, or scaling 80 points and having 2 daughters in the Registry from different dams.

*Brown Swiss :* All bulls having 4 daughters in the Register of Production (advanced Registry) from different dams.

*Guernsey :* All bulls having 2 daughters in the Advanced Registry.

*Holstein :* All bulls having 4 daughters in the Advanced Registry.

*Jersey :* All bulls after 3 of their daughters from as many different dams have been entered in the Register of Merit (Advanced Register) on a year's authenticated fat or butter record.

667 – **Regulations adopted by the Argentine Rural Society for Registering Milk Records of Dairy Cows.** — *Anales de la Sociedad Rural Argentina*, Year LI, No., 1, pp. 74-76. Buenos-Ayres, January-February 1916.

The " Sociedad Rural Argentina " has adopted the following Regulations for the introduction of Registers of the milk records of dairy cows.

CHAPTER I. — (1) The Argentine Rural Society shall, in accordance with the resolutions of its directing Committee, prepare Registers of the milk records of those cows which, according to the present regulations, are recognised as suitable for forming milking strains.

(2) After testing, the milk productivity of imported cows or their offspring, mongrels, crosses and sub-species reared in the country, shall be entered in this Register, provided they fulfil the conditions laid down by the Regulations.

(3) Pure breed cows with a pedigree will be entered in the pedigree Registers for pure bred animals, prepared by the Society in conformity with the Pedigree Regulations ; the milk production will be ascertained and recorded in the margin of the sheet.

(4) This Register will be placed in the charge of the " Comisión de Fomento de la Industria Lechera " (Commission for promoting the Dairy Industry), which will comply with the provisions of articles 5 *et seq.* of the general Regulation for Pedigree Registers, and those of Chapter I, with the exception of article 9.

Under this article, and the corresponding ones cited from the general Regulations for Pedigree Registers, 4 members of the Commission form a quorum.

CHAPTER II. (5) Applications for registration must be made to the

Direction of the Argentine Rural Society, after paying the fees to the "Comisión de Fomento".

(6) Should registration not be granted, the manager of the Society will notify the applicant, and the amount paid in for fees will be returned.

(7) Applications for productivity tests must be made to the manager of the Argentine Rural Society within 30 days after calving, and such tests will be made within 30 days from the application.

(8) The productivity tests may be applied once or for several times for the same cow, on payment of the charge each time, and the results will be entered on the corresponding sheet of the register.

(9) Every heifer calf of a cow which has been tested, accepted and entered in the Register must be declared in the 6th month after birth and marked on the right ear, or branded on the skin, with its progressive number in the private Register of the breeder; it will be entered in the Register of the Argentine Rural Society when, after calving, the owner deems it to possess the qualifications required. Any bull calf of a cow tested, accepted and entered in the productivity Register shall be entered as belonging to a milk-producing family, provided he has been declared and marked on the right ear or branded on the skin, in the 6th month after birth.

(10) Any buyer of a tested cow must notify the Argentine Rural Society of the purchase and request transfer into his name.

(11) The Society will issue certificates of sale of the cows entered in the Productivity Register, specifying the productivity shown during the test period. It shall also issue certificates for heifers, specifying the milk records of the dams, grand-dams, etc., provided the births have been declared within the time fixed and the animals have a tattooed mark in the right ear, or a brand on the skin, according to the breed, with the private Register number.

(12) Any tested cow admitted to the Productivity Register will bear, tattooed on the left ear, the number assigned to it and the mark of the Argentine Rural Society.

(13) Any person committing, or endeavouring to commit, fraud in relation to registration or authorised copies, or in any way impairing the truth and accuracy of the Registers, shall be deprived by the directing Committee of the rights granted by such Registers, and disqualified for benefiting from any connection with them.

(14) To the members of the Argentine Rural Society the tariffs of charges is as follows:

| | Pesos national currency |
|---|---|
| For testing and registering a cow | 5 |
| For registration of a bull | 5 |
| For 1 certificate of sale and copy of register of a tested cow | 5 |
| For 1 certificate of sale and copy of register origin of an untested heifer or bull | 5 |

To non-members these charges are doubled.

(15) Applicants for test must lodge the inspector, and, if the charge does not cover the travelling expenses, must pay the difference.

(16) Milking will take place twice a day, at intervals of 12 hours, in the presence of the inspector.

*Class A.* — The dairy breeds Holstein, Dutch, Flemish, Freiburg, and other similar ones, pure or mongrel, giving the biggest quantities of milk, must show a minimum yield of 4.4 lbs. of butyrometric fat produced during the 5 days of test, in the case of cows having 5 permanent teeth; 4.84 lbs. of butyrometric fat produced in the 5 days of tests, for dairy cows having complete dentition (see Appendix).

*Class B.* — The dairy breeds Shorthorn (Durham), Lincolnshire Red Shorthorn, Red Polled, Hereford, Aberdeen Angus and other similar ones, pure or mongrel (of average productivity) must give a minimum yield of 3.95 lbs. of butyrometric fat produced during the 5 days of tests for cows having 6 permanent teeth; 4. 4 lbs. of butyrometric fat produced in the 5 days of tests for cows having a complete dentition (see Appendix).

*Class C.* — The dairy breeds Jersey, Kerry and other similar ones, pure or mongrel (with minimum production) shall show a minimum production of 3.52 lbs. of butyrometric fat produced during the 5 days of test for cows with 6 permanent teeth; 4.18 lbs. of butyrometric fat produced during the 5 days of test, for cows having their complete dentition (see Appendix).

APPENDIX. — *Approximate equivalents of the daily production of milk and butter-fat required for admission to the Test Register.*

*Class A :* 4.4 lbs. of butyrometric fat during the 5 days of test, with 2.8 % of butter-fat are equivalent to a production of 25.7 pints of milk per day for cows having 6 permanent teeth; 4.84 lbs. of butyrometric fat in 5 days of test, with 8 % of butter-fat are equivalent to 28.16 pints of milk per day, for cows with complete dentition.

*Class B :* 3.96 lbs. of butyrometric fat during the 5 days of test, with 3.2 % of butter-fat, is equivalent to a production of 20.2 pints of milk per day for cows with 6 permanent teeth; 4.4 lbs. of butyrometric fat in the 5 days of test, with 3.2 % of butter-fat are equivalent to a production of 22.9 pints of milk per day for cows with complete dentition.

*Class C :* 3.52 lbs. of butyrometric fat in the 5 days of test, with 4 % of butter-fat, is equivalent to a production of 14.4 pints of milk per day for cows with 6 permanent teeth; 4.18 lbs. of butyrometric fat with 4 % of butter-fat, is equivalent to 16.7 pints of milk per day for cows with complete dentition.

SHEEP

668 – **The Fleece of Russian Coarse-woolled Sheep.** — KOVALEVSKIJ S. N., in *Сельское Хозяйство и Лѣсоводство* (Agriculture and Sylviculture), Year LXXII, Vol. CCL, pp. 20-67. Petrograd, January 1916.

The rapid decline of merino breeding in Russia, the advent of " artificial wool " on the market (obtained by teasing or spreading the fibres of woollen rags), and finally the remarkable stability of the industry of coarse-woolled sheep rearing on peasant farms, suggested a series of experiments with a view to determining the technical and economic value of the fleece from coarse-woolled sheep, especially as, in the view of M. FEDEROV, Professor in the Higher Technical Institute of Moscow, investigations of this kind on local breeds have been entirely wanting up to the present, though they

are of great interest, not only for sheep rearing but also for the wool industry.

The investigations of the wool of local breeds in the province of Voronej (Southern Russia) and other regions, sought to determine : (1) the yield of pure wool ; (2) the proportion of coarse wool (containing medullary substance) and the fine wool (without medullary substance) ; (3) the length and diameter of these wools ; (4) their strength and estensibility.

The conclusions arrived at may be summed up as follows :

1) The fleece of coarse-woolled sheep is made up of 2 kinds of wool, *coarse* and *fine*. The latter can, in point of technical quality, replace merino wool in many woven fabrics, being stronger than the latter. The table showing the results obtained by this and also other experimenters with regard to the strength of different wools, brings out clearly the fact that, while for merino wool the breaking load does not exceed 0.009 to 0.013 grams per square micron, for wools of different coarse-fleece breeds this load varies between 0.014 and 0.020 gr., and is only below breaking strain of merino wools in 2 or 3 cases. Owing to their great strength, these wools will be valuable for woven fabrics requiring great stretching powers, for instance socks and stockings.

With regard to the economic side of the question, a comparison of the respective prices of merino wools and those of coarse-woolled sheep shows that the latter, which averages 40 % of fine wool, does not fetch a price proportionate to its value, fetching only a little more than half that of merino wool. If the importance of the fine wool in sheep with coarse fleece were more appreciated, and manufacturers separated the fine from the coarse, they could then pay one and a half times to twice as much for the coarse wool as they do at present, and be useful both to users and growers. At the same time, the exact valuation of the wool from coarse-fleeced animals according to its contents of fine wool and the quality of this latter, would furnish valuable indications for improvements in sheep-breeding.

2) The investigations of the wool of Karakul sheep did not bear out either the views held in practice as to the coarseness of wool of this breed as compared with other coarse-woolled breeds nor the oft-given advice that breeding rams should be selected on the basis of coarseness of wool. Nor was any relationship observed between the quantity of fine wool and the quality of the fleece in coarse-woolled breeds.

3) The first requisite for the improvement of sheep-rearing and of wool production is the creation of a special central institution for the study of the subject.

4) According to the writer, who studied wools from the morphological point of view and compared the results of his investigations with those obtained by M. Masalik Basil, in reference to the wool of Balkan sheep, the coarse wool (*i. e.* that containing the medullary substance) of coarse-fleeced sheep is polymorphous as regards the form and arrangement of the small epidermic scales. As regards the determination of the breed from these two characters, it will only be possible after an attentive study of the variations peculiar to a given breed.

SILKWORMS

669 – **Experimental Rearing of the Silkworm in "Tilimbars", in Southern Italy.** — Bucci Pietro, in *Le Stazioni sperimentali agrarie italiane*, Vol. LXIX, Part 2, pp. 89-124. Modena, 1916.

Mention is made of the first descriptions of Persian "tilimbars" and previous attempts at rearing in "tilimbars" made in Southern Italy (1), chiefly by Prof. Leonardi at Portici (Naples). After the Law in favour of silkworm rearing was passed in 1912, the following years witnessed a large increase in the number of trials through the initiative of the Ministry of Agriculture. Sometimes the results were inadequate owing to mistakes in construction or position of the "tilimbars", so that they did not form a sufficient shelter and exposed the silkworms to sudden changes of temperature. In most cases, however, the results were satisfactory. Thus, in the rearing work undertaken by the Agricultural Travelling Lecturer's Institute of Benevento with the native yellow race, the "tilimbars" proved effective as regards yield, and furnished silk with properties somewhat better than those possessed by the same worm reared for purposes of comparison in the nurseries. In any case, "tilimbar" rearing gives promise of a large saving in installation and labour expenses.

A detailed description follows of the rearings undertaken on a property of the Royal Oenological School of Avellino, with the yellow "Ascoli-Clementi" breed. The costs of construction of a "tilimbar" 13 × 26 ft. amounted to £ 3. 2 *s* 8 *d*. that of the Friuli "pezzone" (frame) placed therein to 9*s*. $6^1/_2$*d*. The weight of eggs bred was 1.05 ozs. and the total cost £ 7. 6*s*. $3^1/_2$*d*. (as against £ 11. 0*s*. 3*d*. for breeding in the nursery on hurdles), including a depreciation for the "tilimbar" etc. rated at £ 2. 7*s*. 6*d*. The most important results are appended:

| | | "Tilimbar" rearing | Nursery rearing |
|---|---|---|---|
| Good cocoons, per ounce of eggs . . . . . | lbs | 147.7 | 65 |
| Bad and double cocoons . . . . . | per cent | 6 | 7 |
| Number of cocoons per lb . . . . . | | 218 | 520 |
| Cost of production of 1 lb of cocoons . . . | pence | 10.9 | 4.16 |

In order to study the effects which rearing in the "tilimbar" produces on the quality of the silk, an examination was made in the Experimental Laboratory at Milan, of the cocoons obtained in the "tilimbar" and those obtained in the nursery. The following were the principal results:

| Cocoons obtained | Weight of cocoons reeled | Silk produced, absolute weight | Waste per cent. of silk | Weight of 450 meters in "denari" (1 denaro = 0.05 gms.) | Average elasticity | Breaking strain | Loss in gum removal |
|---|---|---|---|---|---|---|---|
| | grms. | grms. | | denari | mm | grms. | % |
| In the "tilimbar" | 296 | 80.116 | 25.75 | 14.41 | 224.88 | 101.32 | 24.96 |
| In the nursery . . | 396 | 83.855 | 26.33 | 13.10 | 225.76 | 94.80 | 25.04 |

(1) See *B.* January 1911, No. 245. (*Ed.*).

*Conclusion.* — The " tilimbar " furnishes a possible solution of the problem of rational silkworm rearing where suitable premises are wanting, as it is clearly proved that on this method cocoons of good quality, even of fairly delicate breeds, such as the native yellow, can be obtained at cost prices below the selling price, even in unfavourable years.

## FARM ENGINEERING.



670 – **Official Trials of Tillage Machines in France.** — SAGNIER, HENRY in *Journal d'Agriculture Pratique*, Year 80. New Series Vol. 29, No. 8, pp. 143-146. Paris, April 20, 1916.

The new series of trials of tillage machines organized by the French Ministry of Agriculture took place at Gournay-sur-Marne (Seine-et-Oise) between April 4 and 13 of this year.

These trials, like those of Grigny and of Chevry-Cossigny of last autumn, are carefully controlled, that is, besides the public trials, other trials are carried on with the same machines under the direction of M. RINGELMANN, director of the Agricultural Machinery Experiment Station, for days and weeks in order to test the work done, the consumption of fuel, the power exerted at the draw-bar etc.

Twenty-two machines were entered for these trials, but owing chiefly to difficulties of transport only about a dozen were presented. They, however, showed what progress has been recently achieved in this line. The following are some of the machines that were tried :

1) Two MOGUL agricultural tractors, one 25 nominal HP, weighing 9460 lbs., and one 16 HP weighing 5440 lbs. The smaller one is remarkable for its adaptability, having been able to haul a pulverizer over ploughed land without in any way injuring the work done.

2) An AVERY 35 HP, tractor weighing 11 550 lbs. which worked very regularly.

3) A 20 brake HP, 4 cylinder EMERSON tractor weighing only 5940 lbs. It showed great regularity of work and adaptability.

4) A MISSVALLEY tractor of careful construction.

5) TOURAND DERGUESSÉS rotary digger provided with powerful tines mounted on parallel shafts.

6) TOURAND DERGUESSÉS motor plough.

7) DUBOIS plough joined to a 4 wheeled two cylinder 20 HP. vertical motor.

Together with the above, a strong tipping motor Corry of the « Sterling » type was presented.

671 – **A Cooperative Society for Machine Ploughing.** — MAX RINGELMANN in *Journal d Agriculture Pratique*, Year 80, New Series, Vol. 29, N° 8, pp. 146, Paris, April 20, 1916.

A cooperative society for machine ploughing was formed in January of this year at Mossais near Confolens (Vienne, France). It is composed of eight members whose farms extend over 578 acres. The fields are

situated close to each other and near the farms, they are from 25 to 62 acres each and on flat or slightly undulating ground, thus being in all respects favourably situated for ploughing by machines. About one third of the acreage is heavy clay, the rest is loam. On the former three pair of oxen cannot plough more than half an acre a day.

The Cooperative Society has chosen a 25 h. p. Case tractor and a three-furrow Sattley plough. The tractor cost about £ 525 and the plough £ 56; the expense is borne by the eight members in proportion to the areas to be ploughed.

The Statutes of the Society are copied from the model drawn up by the Ministry of Agriculture.

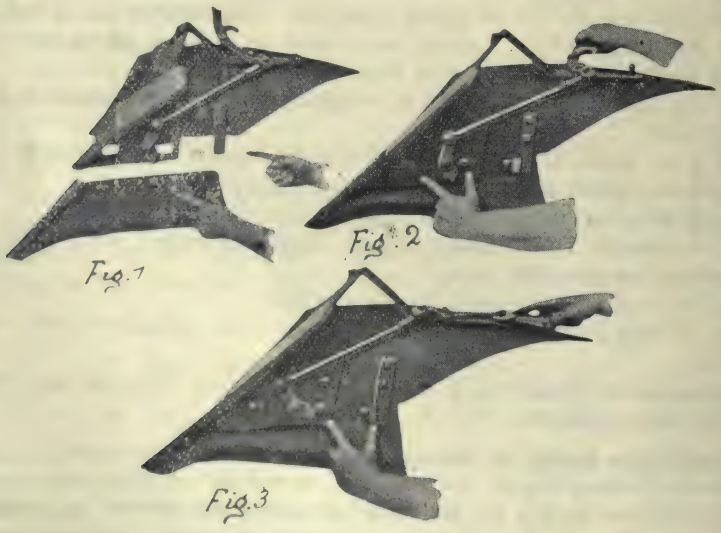
The yearly subscription of each member is 16 shillings and the supplementary contributions may not exceed £ 4. The expenses of all kinds will be divided every month *pro rata* of the acreage ploughed during the time.

The order of succession in which the members are to use the outfit is settled by drawing lots and when the machines have been round once the order will be reversed. A preference, however, is given to the heavier land which is to be ploughed during fine weather.

The society has been granted a subvention of about £ 160 by the Ministry of Agriculture.

672 - **Quickly-detachable Plough Shares.** — *Farm Implement News*, Vol. XXXVII, No. 6 pp. 36. Chicago, February 10, 1916

The new Emerson Brantingham ploughs are fitted with a quickly detachable share which can be removed, it is claimed, in three seconds and replaced in five, without requiring the use of a single tool, not even a wrench.




Quickly-detachable Plough-share.

Fig. 1. shows the studs in the share, the slots in the body of the plough and the levers on the mouldboard and body, which hold the share in position; fig. 2 shows the studs in the slots ready for locking and fig. 3 the share solidly locked.

673 - **Slow-speed and High-speed Motors.** — RINGELMANN, MAX in *Journal d'Agriculture Pratique*, Year 80, Vol. 29 (New Series), Nos. 6 and 7, pp. 111-114 and 125-127 Paris, March 23 and April 6, 1916.

In this paper a comparison is made between slow speed and high speed motors. The writer considers the latter the most advantageous. because they are less bulky, much easier to start, and less liable to the wear and tear due to shocks and vibrations which do not, as some erroneously believe, increase with the speed.

In support of his views he compares two 16 HP. motors of recent construction, having the following dimensions etc. :

| | Slow speed motor | High speed motor |
|---|---|---|
| Number of cylinders | 1 | 4 |
| Bore (millimeters) | 203 | 90 |
| Stroke (millimeters) | 304 | 120 |
| Number of revolutions per minute | 400 | 1200 |

In a properly managed engine there should be no shock at the end of the stroke, as this occurs only when too much play is left between the connecting rod and the crank, and between the shaft and its bearings.

There is, however, a certain shock at the moment of explosion which acts on the inner surface of the compression chamber and on the lower surface of the piston. The effect of this shock may be considerable when early ignition is exaggerated, and it occurs in all motors independently of their speed. At the moment of explosion a sudden increase of pressure is produced and is transmitted to the junction of the piston with the connecting rod and to that of the latter with the crank.

The pressure in kilograms per square centimetre (1 kg. per $cm^2$ = 14.3 lbs. per sq. inch) is easily calculated from the indicator diagrams and is, for the two machines, as follows :

| | Slow speed motor | High speed motor |
|---|---|---|
| Maximum pressure (kilos per sq. cm) | 9 | 12 |
| Total pressure on piston (kilos) | 2912.4 | 763.2 |
| Ratio of total pressures | 3.81 | 1.00 |

Thus, as the sudden pressure on the connecting rod and crank is nearly four times greater in the slow motor than in the rapid one, the working surfaces in the two motors should be in the same ratio to each other, whereas they are relatively larger in the rapid motor.

The wear and tear of the parts is proportional to the number of explosions in the unit of time and is represented by the product of the above ratio 3.81: and 1 by the ratio of the number of explosions per minute.

| | Slow Speed motor | High speed motor |
|---|---|---|
| Number of explosions per minute | 200 | 600 |
| Ratio of above numbers | 0.333 | 1.00 |
| Ratio of total pressures | 3.81 | 1.00 |
| Ratio (product of above ratios) | 1.26 | 1.00 |

Thus the deterioration due to the effect of the explosions is 1 ¼ times greater in the slow engine than in the rapid one.

The *vis viva* (the mass of a body multiplied by the square of its velocity) of the working parts, which, it is claimed produces vibrations and losses of energy, is 3 ½ times higher in the slow speed engine than in the other one, inasmuch as considering only the piston and its weight as a function of its area, the following data are obtained :

| | Slow speed motor | High speed motor |
|---|---|---|
| Number of revolutions per minute | 400 | 1200 |
| Velocity of piston in metres per second | 4.05 | 4.80 |
| Square of piston velocity | 16.40 | 23.04 |
| Area of piston (sq. centimetres) | 323.6 | 63.6 |
| Product of square of piston velocity by area of piston | 5307.4 | 1465.34 |
| Ratio | 3.62 | 1.00 |

On applying the above method to the examination of the injurious effects of the vibrations of the connecting rod, it is found that they are nearly seven times greater in the slow speed motor than in the high speed one. The wear by friction is also greater in the former.

The conclusion that the writer draws is that from every point of view, including also the consumption of fuel, the slow speed is inferior to the high speed motor.

674 - **New Method for the Detection of Unexploded Shells in the Field.** — BOYER, JACQUES in *La Nature*, No. 2219, pp. 239-240, Paris, April 8, 1916.

When shells fall on very wet soil or when their fuses are defective, they often bury themselves in the ground without exploding ; their presence in arable land is a source of danger, as when struck by a plough or other implement, they are liable to explode.

Owing to several fatal accidents to ploughmen, in France, due to this cause, M. GUTTON, professor of Physics at the University of Nancy, with the assistance of M. THIRY director of the Mathieu de Dombasle school, devised an induction balance for the discovery of buried shells.

It consists of two flat coils (fig. 1) $A_1$ and $B_1$ connected in series on the same circuit and traversed by an alternating current inducting two neighbouring coils $A_2$ and $B_2$ also connected in series. In these the winding is so arranged that at any given moment the electromotive forces are respectively contrary.

The coils are 27.6 inches in diameter. Their wires are wound, at the rate of 20 turns for the primary circuit and only 10 for the secondary one,

on two light wooden sieve hoops strengthened by two cross pieces. If the two couples of coils $A_1$ $B_1$ and $A_2$ $B_2$ were exactly identical their electromotive forces would balance each other and the telephone T would be silent. But considering the impossibility of obtaining perfect identity in

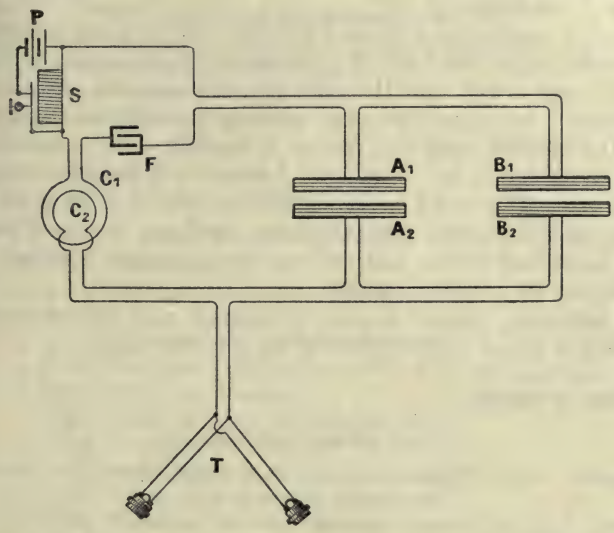



Fig. 1. — Plan of new induction balance for the detection of unexploded shells in the field.

the two couples of coils, a regulating device capable of neutralising the mutual induction of the two circuits has been added. On each of the circuits a small coil of 4 turns of wire is mounted, one of these coils $C_2$ being within the other one $C_1$ on a common diameter. This rotation, by modifying the



Fig. 2. — Method of locating shells in field.

mutual induction of the two circuits, allows the balance to be regulated.

When a mass of iron occurs in the neighbourhood of one of the couples of coils it produces a dissymetry which prevents compensation and causes the telephone to emit a sound.

With this apparatus, 3-inch shells buried at a depth of 16 inches have been detected and even 4 inch projectiles at a depth of over 40 inches.

The alternating current is produced by a battery P of 4 dry cells, with an interrupter S. The induced current in the interrupter coil charges and discharges a condenser F.

When the apparatus is to be used, the two coils are suspended by two vertical sticks from the ends of a horizontal bamboo which is carried by one man in such a way that the coils are kept near the surface of the field to be explored, while another man wearing a telephone head receiver and carrying the battery and the rest of the outfit duly connected with the coils and slung across his shoulders, follows at a distance of a few paces.

When one of the coils passes over iron, even if it be an empty can on the surface of the ground, the telephone produces a sound which varies, however, according to the position the iron occupies, whether on the surface or buried to a certain depth.

This induction balance is easy to manage and two trained men can explore with it about eight-tenths of an acre per hour.

675 – **Review of Patents.**

*Tillage machines and implements.*

United Kingdom 24.402. Manually operated mechanism for pushing a plough or cultivator through the soil.

United States 1 172 553. Plough cultivator.
1 172 763. Abrader for disk harrow blades.
1 172 935. Insect exterminating attachment for cultivators.
1 172 946 — 1 173 822. Plough attachment.
1 173 392. Wheeled plough.
1 173 643 — 1 175 042 — 1 175 507. Ploughs.
1 173 845. Plough wheel.
1 173 985. Detachable plough share.
1 174 640. Subsoil plough.
1 174 699. Yielding mount for ploughs and other tools.
1 174 838. Weeder attachment for cultivators.
1 174 842. Motor cultivator.
1 174 921. Grain tiller.
1 175 003. Combined weeder and cultivator.
1 175 574. Guiding device for plough motors.
1 175 735. Listing plough.

*Manure distributors.*

United States 1 173 037 — 1 174 102. Manure spreader.
1 173 937. Fertilizer distributor.

*Drills and sowing machines.*

United States 1 172 308. Corn and pea planter.
1 174 130. Seed separating mechanism for planters.
1 174 283. Plant setting machine.
1 174 296. Seed covering attachment for grain drills.
1 174 419. Planter.

1 174 606. Three row corn planter.
1 174 991. Planter attachment.
1 175 184 Seeding machine.
1 175 329. Corn planter.

*Reapers, mowers and other harvesting machines.*

United Kingdom 23 543. Machine for collecting, turning and raking hay.
United States 1 172 289 — 1 175 743 Corn harvester.
1 172 326. Power mowing machine.
1 172 665. Threshing harvester.
1 174 159. Grain binder.
1 174 630. Mowing machine.
1 175 296. Grain or hay loader.

*Machines for lifting root crops.*

United States 1 173 042. Beet harvester.
1 175 419. Beet harvesting and topping machine.

*Threshing and winnowing machines.*

Spain 61 671. Improvement in the mechanism of threshing machines.
61 677. Improved winnower.
61 690. Improvements in threshing machines.
61 713. New threshing machine.
United States 1 173 249. Grain separator.
1 173 737. Rotary grain cleaner.
1 174 884. Threshing machine.
1 175 019. Grain saving device for threshing machines.

*Machines and implements for the preparation and storage of grain, fodder etc..*

Spain 61 733. Press for baling straw or the like.
United States 1 173 344. Grain elevator.
1 174 711. Potato sorter.
1 175 702. Hay stacker.

*Other agricultural machines and implements.*

British India 2 230. Improvements in cotton gins.
2 292. Improvements in the carding of kapok and simiilar fibre and the production of a fleece therefrom.
Italy 151 021. Machine for destroying the silk worm chrysalis without injuring the cocoon.
151 521. Improvements in beehives.
151 552. Agricultural and industrial traction engine.
Spain 61 790. Packing for the transport of bananas.
United Kingdom 22 490. Machine for kneading, drying or washing indiarubber.
22 896. Means for controlling heating of incubators.
22 928. Appliance for flaying carcasses.
23 795. Apparatus for collecting yeast during fermentation.
23 940. Fastener for the ends of cask hoops.
24 209. Animal traps.
United States 1 173 004. Tractor attachment for motor vehicles.
1 173 201. Hog oiler.
1 173 313 — 1 175 096 — 1 175 451. Tractors.
1 173 594. Frame for traction engine.

BUILDING CONSTRUCTION

676 – **Hydraulic Fill Method Used to Throw a Temporary Dam Across a Wide Stream** (1). — *Engineering Record*, Vol. 72, No. 26, pp. 794-795. New York, December 25, 1915.

The Imperial Valley in Southern California and the northern part of Lower California (Mexican territory) is irrigated by water taken from the Colorado river just above the international boundary line. The flow of the stream seldom falls below 7000 ft per second which is ample for the needs of the irrigated lands.

In 1915, however, the flow fell below the above minimum thus endangering the supply of the valley. The California Development Co. which owns the main canals and sells water to the mutual distributing companies, in order to save the crops determined to throw a dam across the stream thus diverting the entire flow into the irrigation canal.

For various reasons it was not advisable to put a permanent structure across the river; besides, immediate relief was needed. It was therefore decided to build some temporary earth filled structure, and as dry earth handling methods could not be adopted as only the light alluvial soil could be economically used, hydraulic carriage methods were resorted to, using the heavier materials which are to be found under the present stream bed. These consist of stones up to 6 inches in size and a mixture of clay, alluvium and gravel which when wet has considerable strength and comes through a 10 in. dredge pipe in lumps as large as 6 or 8 in.

It was proposed to deposit this heavier material along the centre line of the dam, so as to form a core, while the lighter stuff would be carried off by the water and partly lost and partly deposited on the upstream and downstream toes.

A 10 inch section dredge with ladder and suction pipe long enough to reach to a depth of 15 ft. below the stream bed was set to work on August 12. The river at that point was 900 ft. wide and 6 to 7 feet deep. In 14 days the dredge carried the dam to an elevation of 12 in. above water level and within 250 ft. of the opposite shore. As the fill rose, two lines of light poles about 30 feet apart were jetted into it and quantities of willow and cottonwood brush piled against them to form two fences between which materials were pumped until the dam was 5 ft. above water level. The result was a dam with a base width of about 150 ft. and a crown of 30ft.

When the work was started the velocity of the current was 2 to 3 ft. per second. As the channel decreased the velocity increased and at closure was about 6 ft.

As the stream is subject to rapid rises, arrangements were made during construction so as to be able to cut it easily, by light blasting, in two places and quickly create two 150 ft. channels.

Before beginning the closure, the bottom was carefully lined with about 10 000 sacks filled with heavy material pumped up by the dredge. The closure, which was made in a water velocity of about 6 ft. per sec. and at the last instant in a depth of about 22 feet of water, was effected with

(1) See also *B.* March 1915, No. 315. (*Ed.*)

the aid of cottonwood and willow brush. This consisted of young trees 6 to 10 in. thick at the butt and 20 to 30 ft. long. Two 1 ¼ in. steel cables were stretched across the gap to afford support to the butts of the young trees while bundles of brush weighted with earth filled sacks were thrown in together with the discharge of the dredge. Closure was effected on Sept. 20.

The structure remained intact till October 3, when owing to a rise of the river it became advisable to blow up the closure section.

According to measurements, the dam contained 30 000 cubic yards of material while the pumping records indicated 40 000 as the quantity raised. The difference is probably due to the fine material washed away.

The cost of pumping was as follows :

| | |
|---|---|
| Labour | $ 578.38 |
| Fuel oil (13 000 gals) | 416.00 |
| Other oil etc. | 100.00 |
| | $ 1094.38 |

On the basis of 40 000 cu. yds. pumped this would give a cost of 2.7 cents per cu. yd. The length of pumping line was never greater than 500 ft.

The total cost of the work was as follows :

| | |
|---|---|
| Earthwork (dredge) | $ 1,100.00 |
| Brush and poles | 333.00 |
| Sacks | 1,140.00 |
| Wire | 32.00 |
| Cable and clamps | 100.00 |
| All labour | 2,000.00 |
| 10 per cent for supervision | 470.00 |
| | $ 5,175.00 |

Against this cost should be set the increased revenue of from $ 700 to $ 1 200 per day from the sale of the water.

It is expected that the present structure will in part be carried away by high water but that a considerable base will be left as a formation for a similar structure next year, should it prove necessary.

677 – **A Dry Heat Sterilizer.** — AQUATIAS, P. in *The Gardeners' Chronicle*, Vol. LIX, Third Series, No. 3914. p. 10. London, January 1, 1916.

The excellent results that follow sterilisation of the soil have been recognised both by scientists and by practical men.

The principle of the operation is to heat the soil to a temperature which will destroy any animal or vegetable organism that it may contain and that might be harmful to crops.

The original practice was to circulate steam in the soil, but this method is onerous and difficult, except where the quantity of soil to be treated

*A dry heat steriliser for soils.*

Fig. 1

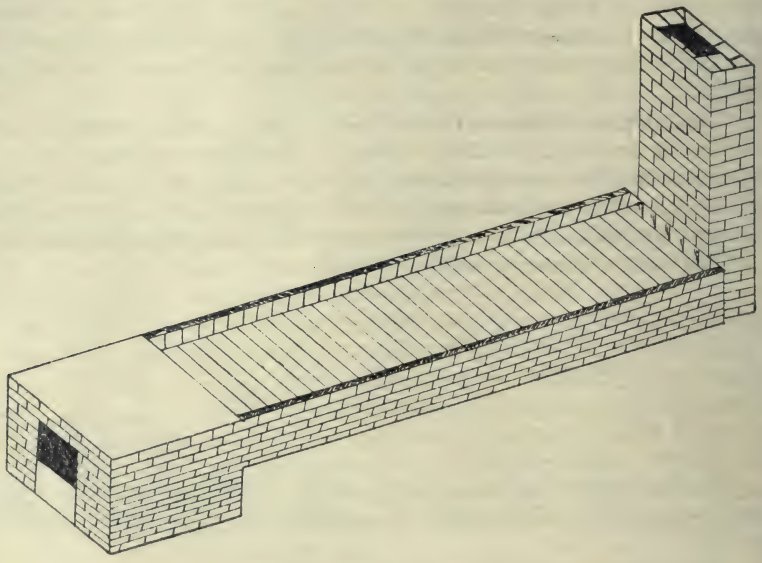


Fig. 2

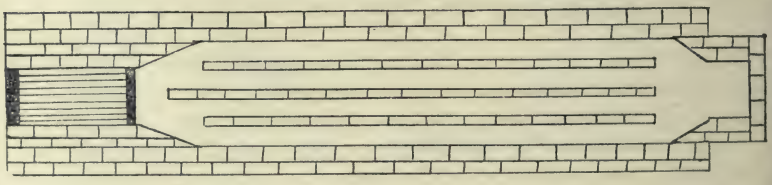


Fig. 3

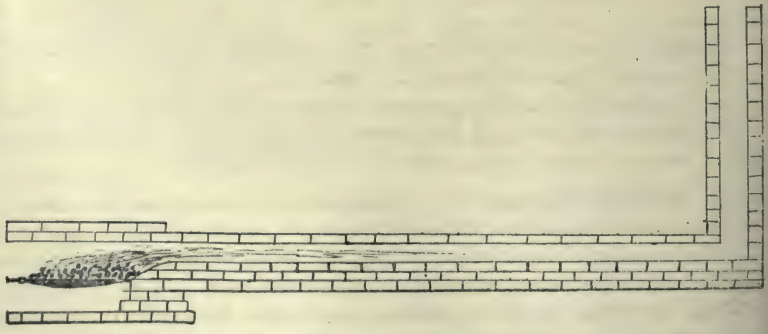


Fig. 1: General View.
Fig. 2: Horizontal section.
Fig. 3: Longitudinal section.

is sufficient to justify the outlay. Dry heat sterilisation has thus been resorted to, and has been found more suitable for the small market growers and private gardeners.

The stove illustrated in the accompanying figures (fig. 1 general view, fig. 2 horizontal section and fig. 3 longitudinal section) is suitable for the purpose; it is built entirely of bricks and will consume any kind of fuel as well as garden refuse.

The floor on which the soil is placed is heated by four flues under it, running from the furnace at one end to the chimney at the other. Its length may vary, according to requirements, up to 15 feet. The overall width is 4 ft. 6 in., the furnace is 1 ft. 6 in. wide, though it may be made wider when it is intended to burn chiefly refuse. The chimney rarely need be more than 4 ft. over the floor of the steriliser unless the stove is situated between high buildings. The outside walls are raised the height of two bricks from the floor to hold the soil and to facilitate covering it during the process of sterilisation.

Once the stove is heated thoroughly, the temperature of the soil reaches 130° to 140° F. It is left for two or three hours, when it is turned and left again for a similar period.

The heat is more accentuated when the soil is in a moist condition (but not excessively) and kept covered with bags. The temperature to which the soil is heated by this means is certainly lower than when steam sterilisation is practised, but the length of time the soil is kept at such a temperature compensates for this deficiency, and experience proves the result to be equally beneficial to the crop.

## RURAL ECONOMICS.

678 – **Influence of the Size of Farms on their Gross Yield.** — LAUR PROF. in *Archiv für exakte Wirtschaftsforschung* (*Thünen Archiv*), Vol. 7, Nos. 2 and 3, pp. 248-287. Jena, 1916.

The methods of enquiry adopted by German writers in determining the relations between the size of a farm and its gross return are first dealt with. It is noted that the results of certain farms have been generally ascertained by the business books and question sheets, the farms being afterwards classified according to size. It has not been possible to make use of the account books except in few cases, and most of the accounts were not even classified and checked by the enquirers. Among the figures determined by the German Agricultural Accounts Office only those furnished by the "Deutsche Landwirtschafts-Gesellschaft" (German Agricultural Society) can be utilised. The enquiries of German writers therefore have not sufficiently cleared up the problem, and this can only be done by comparing the results obtained by the proper keeping of accounts on a large number of farms. It is held that the enquiries made since 1901 by the Swiss Peasants' Secretariat, which to-day cover 2878 closed accounts, are more accurate from

TABLE I. — *Gross Return per Acre with Forest.*

| Year | Small farms (7-12 acres) | | Small peasant farms (12-24 acres) | | Peasant farms (24-37 acres) | | Large peasant farms (37-74 acres) | | Large farms (above 74 acres) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number of farms | £ per acre | Number of farms | £ per acre | Number of farms | £ per acre | Number of farms | £ per acre | Number of farms | £ per acre |
| | | £ s. d. | | £ s. d. | | £ s. d. | | £ s. d. | | £ s. d. |
| 1901 . . . | 11 | 9 6 7 | 38 | 8 19 9 | 34 | 7 15 2 | 23 | 6 17 2 | 4 | 5 18 0 |
| 1902 . . . | — | — | — | — | — | — | — | — | — | — |
| 1903 . . . | 16 | 13 0 5 | 39 | 10 10 2 | 42 | 10 8 11 | 29 | 8 9 2 | 10 | 8 13 4 |
| 1904 . . . | 24 | 13 17 6 | 62 | 10 5 — | 48 | 8 11 2 | 42 | 8 10 10 | 6 | 5 16 4 |
| 1905 . . . | 22 | 17 12 3 | 82 | 10 10 2 | 38 | 7 14 6 | 49 | 8 14 11 | 11 | 6 8 3 |
| 1906 . . . | 25 | 11 17 — | 94 | 11 15 2 | 48 | 9 7 9 | 50 | 8 14 0 | 13 | 7 2 4 |
| 1907 . . . | 24 | 13 12 3 | 101 | 11 10 7 | 60 | 8 15 7 | 52 | 9 16 9 | 13 | 7 11 7 |
| 1908 . . . | 29 | 12 13 8 | 115 | 12 1 3 | 62 | 10 7 7 | 63 | 9 14 2 | 18 | 8 14 14 |
| 1909 . . . | 39 | 13 6 10 | 114 | 12 1 3 | 63 | 10 8 11 | 42 | 10 2 2 | 18 | 8 9 3 |
| 1910 . . . | 38 | 14 8 7 | 110 | 12 8 11 | 61 | 11 12 11 | 42 | 9 15 2 | 19 | 8 0 3 |
| 1911 . . . | 31 | 14 14 11 | 126 | 13 4 7 | 63 | 11 12 11 | 46 | 10 6 0 | 17 | 8 6 7 |
| 1912 . . . | 27 | 17 15 5 | 133 | 14 8 3 | 66 | 12 18 6 | 46 | 11 16 1 | 19 | 10 12 9 |
| 1913 . . . | 29 | 15 3 7 | 126 | 12 8 11 | 73 | 10 11 9 | 58 | 10 3 5 | 17 | 8 1 3 |
| Totals and averages 1901-1913 | 315 | 13 15 9 | 1140 | 11 13 8 | 658 | 10 0 6 | 542 | 9 8 2 | 165 | 7 15 0 |

TABLE II. — *Comparison between Gross Return of Small Farms and other Farms with Forest.*

| Year | Small farms | Small peasant farms | Peasant farms | Large peasant farms | Large farms |
|---|---|---|---|---|---|
| 1901 . . . . . | 100 | 98 | 83 | 74 | 62 |
| 1902 . . . . . | — | — | — | — | — |
| 1903 . . . . . | 100 | 83 | 80 | 65 | 67 |
| 1904 . . . . . | 100 | 74 | 62 | 62 | 43 |
| 1905 . . . . . | 100 | 60 | 44 | 50 | 36 |
| 1906 . . . . . | 100 | 99 | 79 | 73 | 60 |
| 1907 . . . . . | 100 | 85 | 65 | 72 | 56 |
| 1908 . . . . . | 100 | 95 | 82 | 77 | 69 |
| 1909 . . . . . | 100 | 90 | 78 | 76 | 63 |
| 1910 . . . . . | 100 | 86 | 81 | 68 | 56 |
| 1911 . . . . . | 100 | 90 | 79 | 70 | 57 |
| 1912 . . . . . | 100 | 89 | 80 | 73 | 66 |
| 1913 . . . . . | 100 | 82 | 70 | 67 | 53 |
| Averages 1901-1913 . | 100 | 84 | 72 | 68 | 57 |

TABLE III. — *Gross Return without Forest per Acre of Unforested Area.*

| Year | Small farms (7-12 acres) | | | | Small peasant farms (12-24 acres) | | | | Peasant farms (24-37 acres) | | | | Large peasant farms (37-74 acres) | | | | Large farms (above 74 acres) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number of farms | £ per acre | | | Number of farms | £ per acre | | | Number of farms | £ per acre | | | Number of farms | £ per acre | | | Number of farms | £ per acre | | |
| | | £ | s | d | | £ | s | d | | £ | s | d | | £ | s | d | | £ | s | d |
| 1901 | 11 | 10 | 10 | 6 | 38 | 10 | 6 | 8 | 34 | 8 | 13 | 8 | 23 | 7 | 19 | 7 | 4 | 6 | 2 | 10 |
| 1902 | 7 | 11 | 0 | 1 | 18 | 10 | 9 | 3 | 18 | 9 | 7 | 9 | 12 | 8 | 9 | 2 | 3 | 8 | 6 | 11 |
| 1903 | 16 | 13 | 4 | 7 | 39 | 11 | 11 | 3 | 42 | 11 | 11 | 3 | 29 | 9 | 2 | 7 | 10 | 9 | 2 | 0 |
| 1904 | 24 | 14 | 9 | 3 | 62 | 11 | 2 | 0 | 48 | 9 | 11 | 3 | 42 | 9 | 7 | 2 | 6 | 6 | 5 | 8 |
| 1905 | 22 | 17 | 14 | 6 | 82 | 11 | 8 | 9 | 38 | 9 | 14 | 14 | 49 | 9 | 17 | 7 | 11 | 5 | 4 | 11 |
| 1906 | 25 | 12 | 18 | 6 | 94 | 12 | 15 | 3 | 48 | 10 | 18 | 2 | 50 | 9 | 10 | 8 | 13 | 7 | 14 | 8 |
| 1907 | 24 | 14 | 15 | 7 | 101 | 12 | 17 | 5 | 60 | 7 | 0 | 9 | 52 | 11 | 0 | 9 | 13 | 8 | 7 | 7 |
| 1908 | 29 | 13 | 10 | 4 | 115 | 13 | 0 | 13 | 62 | 11 | 6 | 10 | 63 | 10 | 18 | 6 | 18 | 9 | 7 | 2 |
| 1909 | 39 | 14 | 0 | 10 | 114 | 13 | 6 | 2 | 63 | 11 | 12 | 0 | 42 | 11 | 10 | 4 | 18 | 9 | 4 | 10 |
| 1910 | 38 | 15 | 10 | 4 | 110 | 13 | 12 | 0 | 61 | 12 | 18 | 9 | 42 | 10 | 19 | 9 | 19 | 8 | 17 | 11 |
| 1911 | 31 | 16 | 0 | 9 | 126 | 14 | 5 | 0 | 63 | 13 | 2 | 4 | 46 | 11 | 9 | 1 | 17 | 9 | 4 | 6 |
| 1912 | 27 | 17 | 10 | 7 | 133 | 15 | 12 | 10 | 66 | 14 | 8 | 0 | 46 | 13 | 4 | 10 | 19 | 12 | 3 | 2 |
| 1913 | 29 | 11 | 6 | 4 | 126 | 13 | 9 | 8 | 73 | 11 | 6 | 6 | 58 | 12 | 0 | 0 | 17 | 9 | 1 | 1 |
| Totals and averages 1901-1913 | 322 | 14 | 2 | 5 | 1158 | 12 | 11 | 10 | 674 | 10 | 17 | 7 | 554 | 10 | 8 | 6 | 168 | 8 | 7 | 11 |

TABLE IV. — *Comparison between Gross Return of Small Farms and other Farms without Forest.*

| Year | Small farms | Small peasant farms | Peasant farms | Large peasant farms | Large farms |
|---|---|---|---|---|---|
| 1901 | 100 | 98 | 83 | 76 | 58 |
| 1902 | 100 | 95 | 85 | 77 | 76 |
| 1903 | 100 | 87 | 87 | 69 | 69 |
| 1904 | 100 | 77 | 66 | 65 | 43 |
| 1905 | 100 | 64 | 49 | 54 | 41 |
| 1906 | 100 | 99 | 84 | 74 | 60 |
| 1907 | 100 | 85 | 69 | 75 | 57 |
| 1908 | 100 | 96 | 86 | 81 | 69 |
| 1909 | 100 | 95 | 82 | 81 | 66 |
| 1910 | 100 | 88 | 84 | 71 | 57 |
| 1911 | 100 | 90 | 83 | 72 | 58 |
| 1912 | 100 | 89 | 82 | 75 | 69 |
| 1913 | 100 | 83 | 69 | 73 | 55 |
| Averages 1901-1913 | 100 | 87 | 77 | 72 | 59 |

this standpoint. These accounts are kept on a uniform system on peasant farms, and are continually verified.

In the following chapter the writer refers to his investigations for the purpose of ascertaining, by means of the above material, the relation between the size of farms and the gross return, for Switzerland. By " gross return " is meant the gross final return of the entire business, that is, the gross return of all branches of the agricultural undertaking. There are considerable difficulties in the way of determining this. In order to compare the gross returns of different farms, they must be determined on the same methods, or at least according to uniform principles. At the request of the International Institute of Agriculture, the writer formulated principles for the estimation of the gross return based on the method adopted by the Swiss Peasants' Secretariat (1). The enquiries made by the Swiss Peasants' Secretariat determined the gross returns per acre *with* and *without* forest ; the writer proceeded in the same way.

Table I classifies the gross returns per acre with forest according to the size of the farms. In Table II the gross return of small farms stated as 100 is compared with that of the various other descriptions of agricultural undertakings with forest (see following page).

It appears from this that the gross return per unit of area increases regularly in proportion as the size of the undertaking diminishes. The influence of the size is so great tha it is evident even in the simple yearly results. The constancy of this relation is the more striking in view of the fact that part of the farms in question undergo changes from year to year. The accounts moreover are kept under different conditions. Part of them deal with intensive cultivation of the Swiss tableland, while others relate to farms in the high mountainous regions. The farms are not selected, but are admitted to the checking scheme following upon a simple entry. From all these facts it is concluded that, in enquiries of this kind, the number and accuracy of the observations are more important than the question whether the conditions under which the results are obtained are comparable with each other.

The calculation of the gross return may be affected by the area under forest and pasturage. In the enquiries of the Swiss Secretariat the forest is only considered in the " agricultural " account in so far as it may serve to supplement the farm work proper ; its effect therefore is slight. The gross yield is also calculated per unit of area without forest. In Switzerland it is not usual for pasturage of any extent to belong to the farmer, except in certain parts like the Jura. In others, pasturage is in the hands of agricultural societies and corporations. The yields of these pasturages, which are not included in the area of the farm, increases, though very slightly, the comparative gross return per unit of area. In order to measure this increase, the writer calculates a " pasturage factor ", reducing the quantity of forage consumed on pasturages outside the property to the yeld of grassland

(1) See, in *B.* 1914, pp. 193-208, the article by Dr. Laur entitled : Principles for Preparation of International Statistics of Agricultural Accounts.

of average productivity by estimation. On multiplying this factor by the return obtained per unit of area of the farm, there is obtained the gross return of farm working including pasturage.

Table III indicates the gross return without forest per acre of unforested area, and Table IV compares the gross return of small farms taken as 100) to that of various other descriptions of farms without forest (see above).

These figures also show that the gross returns increase in proportion as the size of the farms diminishes.

The writer has also classified the figures ascertained by the Swiss Peasants' Secretariat according to the different systems of cultivation and size of farms. The results for some of the principal groups for the years 1904-1913 are indicated in Table V.

It is also seen here that the larger the farm the smaller the gross return, but exceptions are more numerous than in the Tables where all the farms were taken into account, owing to the fact that in Table V the years affect the results, and the number of completed accounts for many groups is still so small that the personal influence of the farmer, the position of the market, the system of working, natural factors, etc. may still make themselves felt. All these exceptions, however, cannot modify the fact that the gross return is larger in proportion as the farm is smaller, a fact which the writer regards as being scientifically established for Switzerland.

The enquiries of the Swiss Peasants' Secretariat also show what portion of the gross return is used for supplying the farmer's family and what portion is sold on the market. Taking an average of the years 1901-1913 the aggregate gross return (with forest) was utilised as shown in Table VI.

TABLE VI. — *Utilisation of the aggregate Gross Return with Forest, Average for* 1901-1913.

| Sizes | Marketed | | | | Used for Home supplies | | | |
|---|---|---|---|---|---|---|---|---|
| | per cent | £ per acre | | | per cent | £ per acre | | |
| | | £ | *s* | *d* | | £ | *s* | *d* |
| Small farms | 67.66 | 9 | 8 | 9 | 32.34 | 4 | 9 | 7 |
| Small peasant farms | 75.43 | 8 | 16 | 3 | 24.57 | 2 | 17 | 7 |
| Peasant farms | 78.92 | 7 | 18 | 3 | 21.08 | 2 | 2 | 2 |
| Large peasant farms | 81.24 | 7 | 12 | 10 | 18.76 | 1 | 15 | 2 |
| Large farms | 86.09 | 6 | 14 | 11 | 13.91 | 1 | 1 | 8 |
| General averages | 79.11 | 8 | 2 | 0 | 20.89 | 2 | 9 | 3 |

The figures show that not only the gross return but even sales on the market increase per unit of area in proportion as the size of the farms diminishes.

It is well known that small farms use a relatively larger quantity of produce for supplying the farmer's family than large farms.

In the next chapter, the results of the enquiries made by German authors are reviewed. It is concluded that in Germany too, the increase in the size of the farms reduces the gross return. The materials on which these results are based are still insufficient, but it is believed that more extensive and precise enquiries would confirm these preliminary results. In consideration of the economic importance of this question both from the private and national point of view, it would be advisable to continue these enquiries in Germany, and endeavour to obtain a definitive result based on scientific investigations. This would be most effectively secured by creating central Agricultural Accounts Offices, whose duty it would be to check a sufficient number of farms in each region by keeping careful accounts.

In the last chapter, the causes to which the larger gross return of small farms are to be ascribed are enquired into. By calculations and tables it is shown that the higher amount of yield is chiefly due to the fact that small farms are relatively better supplied with cattle, which also results in an enhanced value of crop production. Besides these, there are a number of branches, such as arboriculture, vine-growing, bee-keeping, poultry-keeping and market-gardening, special to small farms, which contribute to increase the gross return. In addition, in calculations based on accunts, the rent paid by the " private "account to the " agricultural " account also increases the gross return of the farm.

Finally, some questions requiring still more thorough study in order to solve the problem of the best size of farm are touched upon. The chief points to be determined by thorough enquiry are : the amount of return in produce of the soil ; the influence of the quantity of livestock on the final gross return of the farm ; the productive capacity of farms generally and fields in particular for home supplies and the market.

Probably the small farm yields larger money values per unit of area and also produces a bigger money value for the market, but at the same time furnishes less of nutritive elements (thermal units and starch values) for human sustenance than the large farm chiefly engaged in growing crops for the market. The writer proves by calculation that the larger the number of livestock relatively to the farm, and consequently the smaller the latter, the lower is the production of nutritive elements for human food. His figures suggest that the large farm, chiefly engaged in crop-growing for the market, is of special importance in countries where industrial wages are low and where the people live chiefly on vegetable products, but that in countries rapidly increasing their national wealth, and where wages, the exportation of manufactured products, and the consumption of meat are on the increase, the importance of small farms likewise grows. From the point of view of intensive livestock production, there is certainly a difference between the productivity of the large and the small farm. From this point of view also fresh enquiries are needed into the gross return of different sizes of farms.

TABLE V. — *Gross Return of Farms Classified according to System of Cultivation* (1904-1913).

| System of Cultivation | Small farms | | | | Small peasant farms | | | | Peasant farms | | | | Large peasant farms | | | | Large farms | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number of farms | £ per acre | | | Number of farms | £ per acre | | | Number of farms | £ per acre | | | Number of farms | £ per acre | | | Number of farms | £ per acre | | |
| | | £ | s | d | | £ | s | d | | £ | s | d | | £ | s | d | | £ | s | d |
| Farms with improved three-year rotation | 63 | 12 | 8 | 10 | 277 | 10 | 8 | 3 | 71 | 10 | 10 | 10 | 41 | 8 | 8 | 0 | 3 | 6 | 18 | 6 |
| Farms cultivated on a clover basis — Berne | 7 | 13 | 8 | 5 | 44 | 12 | 8 | 5 | 47 | 10 | 14 | 4 | 97 | 11 | — | — | 21 | 10 | 9 | 3 |
| Farms cultivated on a clover basis — Lucerne | 2 | 16 | 2 | 6 | 35 | 13 | 11 | 3 | 35 | 12 | 0 | 11 | 13 | 10 | 14 | 11 | 15 | 11 | 11 | 3 |
| Farms cultivated on a clover basis — Soleure, Bâle-Champagne, Argau | 10 | 16 | 17 | 7 | 53 | 11 | 16 | 1 | 46 | 9 | 12 | 0 | 31 | 8 | 6 | 4 | 1 | 8 | 18 | 2 |
| Farms cultivated on a clover basis — French Switzerland | 1 | 17 | 6 | 6 | 66 | 11 | 1 | 0 | 28 | 9 | 0 | 5 | 59 | 9 | 9 | 4 | 25 | 8 | 5 | 0 |
| Stock farms with cultivation | 24 | 14 | 8 | 0 | 146 | 12 | 10 | 2 | 45 | 9 | 9 | 0 | 32 | 11 | 10 | 4 | 3 | 7 | 15 | 6 |
| Stock farms proper — on the Swiss-German plateau | 30 | 17 | 4 | 0 | 107 | 14 | 17 | 3 | 35 | 10 | 14 | 0 | 20 | 11 | 6 | 6 | 10 | 9 | 0 | 5 |
| Stock farms proper — in the Alpine valleys | 46 | 17 | 6 | 10 | 80 | 10 | 16 | 11 | 59 | 9 | 19 | 7 | 23 | 8 | 3 | 2 | 8 | 3 | 4 | 3 |
| Stock farms proper — in the special fruit-growing regions | — | | — | | 36 | 19 | 8 | 5 | 28 | 15 | 13 | 7 | 27 | 14 | 1 | 10 | — | | — | |
| Stock farms proper — with pasturage | — | | — | | 3 | 13 | 5 | 10 | 22 | 13 | 9 | 0 | 7 | 11 | 7 | 5 | 2 | 19 | 4 | 3 |
| Stock farms proper — Lucerne | 1 | 10 | 8 | 7 | 16 | 17 | 8 | 9 | 9 | 8 | 10 | 2 | 30 | 7 | 12 | 6 | 5 | 11 | 15 | 1 |
| Alpine farms | 4 | 10 | 17 | 10 | 30 | 8 | 7 | 3 | 38 | 6 | 18 | 10 | 12 | 7 | 14 | 2 | 6 | 2 | 8 | 3 |
| Farms of the high valleys of Valais and Graubünden | 34 | 11 | 11 | 3 | 36 | 10 | 7 | 3 | 11 | 4 | 8 | 0 | 14 | 7 | 14 | 2 | — | | — | |

## AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

679 – **"Natural Wheat Bread".** — *L'Agricoltura toscana*, Year VII, Part 8, pp. 163-164. Florence, April 30, 1916.

In the municipal bakery of Bergamo (Italy) the manufacture of "natural wheat bread," *i. e.* bread obtained from the whole grain, has been undertaken with excellent results.

The wheat after careful cleaning and sifting is put into a bath of lukewarm water in which it is steeped for 48 to 60 hours according to its hardness. During this steeping the wheat is "vitalised", that is to say, the germ begins to develop and the constituents of the integument soften and change in a marked degree. The wheat when vitalised to the required extent is put into a grinding and kneading machine, where it is converted into dough, from which the loaves ready for baking are cast. All milling operations are thus eliminated and with them every risk of adulteration and deterioration of the flour. The "natural bread" is grey in colour, of a very pleasant odour and taste, and much superior in nutritive qualities to common white bread, being rich in fats, vegetable lecithin and pepsin.

As the whole of the wheat is utilised, the returns are very high; at the municipal bakery of Bergamo, in February 1915, the wheat converted into bread yielded for 100 lbs weight, an average of 136 lbs of "natural bread", with an average of 26 to 27 % of moisture. On the other hand, with ordinary methods of bread-making, even when flour which gave 85 % in bolting is used, 1 cental of wheat cannot yield more than 102.2 lbs of bread, reckoning a yield of 120 lbs of bread per cental of flour.

The Bergamo bakery sells the "natural bread" in small rolls of just over 2 ounces at the price of 2*d* per lb.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

680 – **Chemical Comparison between two Fermented Milk Products: the "Laben raieb" of Egypt and the "Miciuratu" of Sardinia.** — SANNA A., in *Le Stazioni sperimentali agrarie italiane*, Vol. XLIX, Part 2, pp. 773-88. Modena, 1914.

The product termed "miciuratu" in Gallura (north of Sardinia) where it is largely consumed, and "gioddu" in the rest of Sardinia, is prepared as follows: After boiling milk (cow's, ewe's or goat's, or a mixture of the three) for 5 or 6 minutes, it is poured off and allowed to cool to a temperature slightly above 37° C. in a specially made wooden vessel; the ferment diluted in warm milk is then added, the whole is mixed and the vessel covered with a piece of woollen cloth and left standing for about 7 hours, the milk is then found to be curdled into a doughy mass and the "miciuratu" is ready.

The preparation of "laben raieb" is almost the same as that of "miciuratu". In any vessel (as big as possible) cow's or ewe's milk is heated without bringing to the boil (up to about 80° C.) until reduced to about $^2/_3$ of its original volume; it is then poured off into small vessels and allowed to cool to 35° C. Next, by means of a syringe, and without mixing the liquid, the surface of which is covered with cream, 5 cc. of "laben raieb" made the day before and previously diluted in a small quantity of milk re-

duced as above, is added for each 1 ¼ pint of reduced milk. The vessel is then wrapped in cloth, so that it retains a temperature of about 35° C. for 5 hours (during which period it coagulates); the cloth wrapping is then removed and cooling takes place.

The analysis of "miciuratu" prepared with cow's milk at the cheese factory of the Oenological School of Cagliari gave the results shown in Table I.

TABLE I. — *Percentage Composition of "Miciuratu".*

| Components | Milk before fermentation | Milk after 8 hours fermentation | "Miciuratu" after 1 day | "Miciuratu" after 2 days | "Miciuratu" after 3 days |
|---|---|---|---|---|---|
| Density | 1.308 | — | — | — | — |
| Cream | 13.00 | — | — | — | — |
| Fats | 5.9 | 5.8 | 5.8 | 5.04 | 4.65 |
| Water | 82.40 | — | — | — | — |
| Extract | 17.60 | — | — | — | — |
| Ash | 0.843 | — | — | — | — |
| Acidity | 0.25 | 0.68 | 1.072 | 1.370 | 1.620 |
| Casein | 4.321 | 4.863 | 4.628 | 4.590 | 4.578 |
| Albumen | 0.997 | | | | |
| Sugar | 4.024 | 3.485 | 2.994 | 2.586 | 2.240 |
| Glycerine | — | traces | traces | clearly marked traces | clearly marked traces |

The acidity certainly continues to increase even after the 3rd day, but beyond that time the product becomes unfit for use owing to butyric fermentation. The acidity is chiefly due to non-volatile acids (lactic and succinic). The acidity due to volatile acids on the 3rd day was 0.03 per 1000; the presence of acetic and formic acid was observed. Traces of ethyl-aldehyde were detected in "Miciuratu" and also ethyl-alcohol in the following proportions:

| | |
|---|---|
| After 8 hours | 0.18 per 1000 |
| After 1 day | 0.34 » |
| After 2 days | 1.70 » |
| After 3 days | 2.06 » |

These results prove that during the conversion into "miciuratu" the 3 principal constituents of milk: sugar, fats and nitrogenous substances, undergo well-marked fermentation. The most notable is the fermentation of the sugar with formation of lactic acid. There are likewise other products of oxidation, such as ethyl-alcohol and ethyl-aldehyde. To judge from organoleptic analyses, acetic ether does not appear to be absent.

The pure fat is transformed, but this transformation is the least marked The reduction in fatty matter is almost negligible. Albumen and casei undergo partial peptonisation.

The analysis of " laben raieb " made from buffalo cow's milk gave th results indicated in Table II.

TABLE II. — *Percentage Composition of " Laben raieb ".*

| Components | Milk before fermentation | Milk after 8 hours fermentation | « Laben raieb » after 1 day | « Laben raieb » after 2 days | « Laben raieb » after 3 days | Commercia « Laben raieb » |
|---|---|---|---|---|---|---|
| Density | 1.032 | — | — | — | — | — |
| Fats | 8.27 | 8.11 | 8.00 | 7.91 | 7.86 | 3.98 |
| Water | 81.67 | — | — | — | — | — |
| Extract | 18.33 | — | — | — | — | — |
| Ash | 0.971 | — | — | — | — | — |
| Acidity | 0.20 | 0.72 | 1.184 | 1.640 | 2.100 | 1.136 |
| Casein | 3.495 | 4.150 | 3.864 | 3.595 | 3.487 | 4.008 |
| Albumen | 0.825 | | | | | |
| Sugar | 4.86 | — | — | — | — | — |
| Glycerine | More and more distinct traces | | | | | |

In " Laben raieb " also there was observed the presence of peptones ethyl-aldehyde and ethyl-alcohol ; the latter in the following proportion (averages of 2 observations) :

| | |
|---|---|
| After 8 hours | 0.14 per 1000 |
| After 1 day | 0.39 |
| After 2 days | 2.35 |
| After 3 days | 2.95 |

*Conclusion.* — " Miciuratu " may be considered as not differing chemically from " Laben raieb ". The fact of the same products of fermentation being found in both suggests that the ferments are also the same (1). It is true that the fermentation of the sugar, and consequently the production of alcohol, are more intense in " laben raieb " and that the contrary is the case in the fermentation of the proteid substances, but only slight quantitative differences are concerned, which may be explained by the difference of concentration of the two products and the difference in temperature of the two countries of production.

(1) In "Laben raieb", E. Rist and J Khoury (*Annales de l'Institut Pasteur*, Vol. 16, p. 65) found the 5 ferments : *Streptobacillus lebensis, Bacillus lebensis, Diplococcus lebensis, Saccharomyces lebensis*, and *Mycoderma lebensis*.

681 - **Fine and Coarse Wool of Russian Sheep.** — See No. 668 of this *Bulletin*.

682 - **The Viscosity of Beeswax and the Substances used for its Adulteration.** — FABRIS UGO, in *Le Stazioni sperimentali agrarie italiane*, Vol. XLVIII, Part 8, pp. 595-603. Modena, 1915.

The writer has applied the method of viscosity measurement to the analysis of beeswax, taking the viscosity of nitrobenzol as the standard of comparison. The results are given of the measurements made not only with virgin wax and bleached wax, but also with the substances most used for adulterating these products. The following Table reproduces the maxima and minima found for the viscosity index of the different substances (ratio between the time taken by the substance in question and that occupied by nitrobenzol in flowing between 2 points of reference of the viscosimeter).

The great difference between the viscosity index of beeswax and that of the other substances mentioned, together with the simplicity and rapidity of its determination, lead to the conclusions that this index is of great use in the analysis of wax, and may even at times be used for detecting quantitative proportions.

*Viscosity Index of Beeswax and of the Substances most used in its Adulteration,*

| | Maximum | Minimum |
|---|---|---|
| Virgin beeswax, from different Italian localities. . | 16.30 | 15.23 |
| White wax . . . . . | 17.53 | 16.54 |
| Carnauba wax. . . . . | 43.03 | 42.03 |
| Japanese wax . . . . . | 21.12 | 20.71 |
| Tallow . . . . . | 13.05 | 12.39 |
| Stearin . . . . . | 8.50 | 8.31 |
| Spermaceti . . . . . | 7.42 | 6.74 |
| Paraffin and ceresine. . . . . | 6.69 | 3.48 |

# PLANT DISEASES

## GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES FOR THE PROTECTION OF PLANTS.

683 – **Ordinance relating to Insect Pests and Diseases of Plants, in Western Samoa.** — *British Military Occupation of Samoa.* Proclamation No. 25.

Under date of the 2nd February 1916, the Acting Administrator of Samoa promulgated the following order:

1) All soil, plants, fruit, tappas, native matting, curios or other articles hereafter imported or brought into the Islands of Western Samoa and liable in the opinion of the Commissioner of Agriculture at Apia to be affected with insect pest or other disease shall be subjected to such fumigation or other treatment as the Commissioner shall deem necessary for the destruction of such pest or disease.

2) No importation of soil, plants, fruit, tappas, native matting or curios shall be made except through the port of Apia and the person importing or bringing such articles shall notify the fact to the Commissioner or to the Collector of Customs or in the case of postal packages to the Post Master at Apia. No such importation shall be removed from the Custom House or the Post Office, as the case may be until inspected and passed by the Commissioner.

3) No soil, plants, fruit, tappas, native matting or curios shall be shipped or posted or received for shipping or posting from the Islands of Western Samoa unless accompanied by a certificate of the Commissioner to the effect that such exportation has been passed as free from pest or disease or has been fumigated or otherwise treated for the destruction of same.

4) Every such exportation shall be notified to the Commissioner and deposited at the Fumigation Station for treatment at such time before the departure of the vessel or the closing of the mail by which it is to be shipped or posted as the Commissioner shall require.

5) The following fees shall be charged for fumigation or other treatment for the destruction of pests or disease whether upon imported or exported articles:

| | |
|---|---|
| (*a*) for each box or parcel treated . . . . . | 3d. |
| (*b*) for each plant treated . . . . . | 3d. |

6) Any breach of any of the provisions of this ordinance shall be punishable by the Courts constituted under the Civil Administration of Western Samoa by fine not exceeding five pounds or by imprisonment for not more than 30 days.

684 - **Decree including the "Abrojo grande" (*Xanthium macrocarpum*), among Weeds in Uruguay.** — *Revista de la Asociación rural del Uruguay*, Year XLIV, No. 12, p. 724. Montevideo, 1915.

Under date of the 9th October 1915 the President of the Republic of Uruguay decreed as follows :

Art. 1. — The plant known under the scientific name of *Xanthium macrocarpum* (= *X. canadense*) and the vulgar name of " Abrojo grande " is declared to be included among weeds.

Art. 2. — The " Defensa Agrícola " will in each particular case advise such means as it considers appropriate for controlling this weed.

## DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

685 - **Factors Contributing to the Lodging of Wheat.** — RIVERA V. in *Le Stazioni sperimentali agrarie italiane*, Vol. XLIV, Part 3-4, pp. 186-199, Pl. I. Modena, 1916.

In previous publications (1) reference was made to the great influence of a reduced distension of the tissues on the constitutional susceptibility of plants to certain fungus attacks ; an enquiry, therefore, into the factors contributing to reduce distension in cultivated plants, is of great importance and may help to elucidate the causes of their liability to certain diseases.

By experiments carried out under glass or in the open at the Royal Station of Plant Pathology in Rome, with cultivations in pots on different media containing salts in different proportions and irrigated, the effect of these factors on the lodging of wheat (" Noé ", " Gentil rosso " and " Marzuolo ferrarese ") was studied. The results obtained and the analysis of differently treated plants led to the following conclusions :

Complete manuring was found to favour lodging more than anything else. Plants fully manured with normal doses of salts proved very liable to lodge as compared with those raised on unmanured soil. The latter on examination showed a larger percentage than the former in dry substance, that is, a smaller quantity of water in the tissues.

The high percentage of water in the tissues is a constant indication of liability to lodging. Such liability is constantly observed not only in plants manured in the ordinary way, but also in plentifully irrigated cultivations and in those which are not sufficiently thinned out.

Among the factors which give rise to the formation of tissues of low consistency (very watery under examination) the following therefore rank in the first place : high content of nutritive salts in the soil, abundant moisture and insufficient light.

(1) See *B.* Dec. 1913 No. 1395 and *B.* May 1915 No. 556. (*Ed.*).

Each of these three factors taken by itself produces a certain degree of tendency to lodge; this tendency is increased under the combined action of two of these factors and attains its maximum when all three operate together.

Among the factors giving rise to the formation of tissues of a more solid character (plants not liable to lodge) reference must be made to the insufficiency of nutritive salts in the soil, dryness and light.

A prolonged drought, therefore, in plants raised in poor soil and kept in full light, produces the lowest degree of tendency to lodge.

The combination of two factors with opposite action moderates the effect of each. Thus there is little tendency to lodge in the case of plants which are manured, but poorly irrigated.

The factors determining the formation of tissues of insufficient consistency, the indication of which is a high percentage of water, are the true causes of lodging as found by experiment; the immediate cause, however, always consists in some drying factor (usually heat). It is concluded from this that the fall of the culm is brought about by the softening of the tissues of which it is built up. The fact that lodging of the culm is constantly preceded by obvious withering of the leaves argues in favour of this explanation.

The explanation of the fact that plants raised and maintained in a soil very rich in water wither and drop more easily than those raised in dry soil might be found in the difficulty of any regulating action in the former, by which the corresponding distension by water might be restored to the parts above ground, this difficulty being due to the development in inverse directions of the absorbing root surface and that of the aerial evaporation and transpiration organs. This same fact, which is also observed in manured as compared with unmanured plants, may explain, at any rate partly, the greater predisposition to softening of the tissues in the former as compared with the latter.

686 – **"Sordago" Disease in the "Marvel of Peru" (*Mirabilis Jalapa*).** — CORRENS C. in *Jahrbücher für wissenschaftliche Botanik*, Vol. 56, pp. 585-616. Leipzig, 1915.

The leaves of the plants attacked showed small light brown blotches on the surface, giving them a spotted appearance. Young plants and the roots of *M. Jalapa* did not at first show any irregularity, but after a time the old leaves showed the characteristic spotting. Little by little, the disease also attacked the younger leaves. The symptoms started at the pointed apex of the leaf and progressed towards the leaf-stalk. The twigs, leafstalks and green fruits never showed any spots. The spots were often so numerous as to touch one another; they only appeared on the upper face of the leaf. The diseased leaves lived nearly as long as the sound ones.

The moment the disease appeared, the plant became sickly and greatly retarded in growth.

The spotting of the leaves occurs in all forms of *M. Jalapa*, which are distinguished from each other by their content of chlorophyll. It was found both in the *typica* form and in the *chlorina* and *variegata* forms. To the

form *semichlorina* alone, which is intermediate between *chlorina* and *typica* it was not possible to transmit the disease.

The brown spots give the chlorophyll a characteristic dirty hue, hence the writer calls the diseased plants " sordidae " and the disease " sordago ".

An examination of the part attacked proved that the disease commences in the palisade cells. The cells die under the influence of an agent as yet unknown, and are then transformed into an amorphous mass which undergoes decomposition. The epidermic cells were never attacked first ; generally they were only attacked after the palisade cells were completely destroyed. The cells below the palisade cells never exhibited any symptoms of disease ; it is therefore localised to these latter.

The diseased plants studied originated : *a*) from a culture made about 10 years ago with the form *variegata* which was probably already diseased ; *b*) from a plant belonging to the group *gilvaroseostriata* (dark leaves), which was certainly free from the disease. This latter plant, in 1910, after self-fertilisation, produced progeny to the number of 65, of which 13 had " sordago " disease.

The sister plants of those which produced " sordidae " having all produced healthy progeny, the conclusion was drawn that the parent-plant of the " sordidae " is the product of a mutation of the sexual cell of *M. Jalapa*.

As *M. Jalapa* cannot stand the winter cold, the roots are kept in cellars during the cold period. It has been found that individuals suffering from " sordago " retain the disease for years. Young plants at first showed no growth anomalies, but after a time the spots appeared on the leaves. The characters of the disease are not influenced by external factors. On the other hand, plants which were not attacked in the first year remained free afterwards.

" Sordago " is hereditary and is transmitted according to Mendelian laws.

When a plant normal in appearance, after fertilisation, produced healthy and diseased offspring the latter were generally in the proportion of 25 per cent. The parent of this offspring was therefore heterozygous (normal + " sordidae ") with the " normal " state dominant over the " sordago " state. This fact is confirmed by the characters of the progeny in further generations.

By cross-fertilisation of " sordidae " plants, diseased progeny exclusively was obtained. All the progeny therefore were homozygous.

On cross-fertilisation of healthy plants, it was found that one third produced only healthy progeny and two thirds gave both " sordidae " and healthy in the proportions of 1 : 3.

From this it is concluded that we are confronted here with typical monohybridism in which the character of the " sordidae " plants is recessive to such an extent that it is impossible to distinguish the normal homozygotes from the heterozygotes. All these facts result from numerous experiments of which a full description is given.

The experiments also show that the " sordidae " plants are much

lighter and smaller than the normal ones, probably owing to deranged metabolism.

The study of this interesting disease is being continued.

687 **"Spike Disease" in Sandal, in India.** — LUSHINGTON P. M. in *The Indian Forester*, Vol. XLII, No. 2., pp. 61-65. Allahabad, February 1916.

The disease of the sandal tree known in India as the "spike disease", first described by MC CARTHY in 1902, has been widely prevalent latterly, causing great damage in Germalam, Bylur and Jadathadi Halla in North Coimbatore, the Gundal valley, Hassanur, and Thattakarai on the Burgur plateau.

In the Southern circle there are two infected areas at Iowlagiri and Tholuvabetta, which are separated by an 18 mile belt partly wooded, where no diseased plants occur; LATHAM recently found an infected tree, quite an isolated case, at Salem, 60 miles south-east of Tholuvabetta.

In the Trichinopoly district, there are the two infected localities of Jambuthu and Chelliapotti separated by entirely immune belts and situated at a great distance from the other infected areas.

The infection is very virulent: the disease spreads rapidly from one tree to all the surrounding plantations, causing heavy ravages. Although birds and insects can convey the fungal spores over wide distances, the disease, to judge from the geographical distribution of the infected areas, is endemic in character.

Little is known about the cause of the "spike disease". The present position of the question may be summed up as follows:

1) The chief symptom is phyllody accompanied by excess of starch in the stem, twigs and leaves.

2) In the trees attacked the root ends die and the haustoria are either absent or dead.

3) The refuse of diseased trees is sometimes normal, sometimes infected with phyllody.

4) Specimens are often observed in which only some parts of the branches and stem show signs of disease, all the rest remaining healthy. The pruning of unhealthy parts does not stop the disease, the plants always dying.

5) Healthy young seedlings are frequently observed in diseased areas, under cover of scrub, which appears to protect them; they are liable to the disease however the moment they get their heads above the scrub.

6) No trace of fungus disease was found and attempts to infect by means of contaminated material were quite negative in results.

7) Other trees besides the sandal are attacked by a disease having an appearance similar to "spike", for instance *Zizyphus Oenoplia*, *Dodonaea viscosa*, and *Pterolobium indicum*. No relation has yet been established, however, between these different diseases.

# DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

GENERALITIES

688 - **Vegetable Parasites of Cultivated or Useful Plants observed in 1913 in the Government of Tula, Russia.** — TRUDOV J. in *Materiali po Mikologhii i Fitopatologhii Rossii*, Year I, Part 4, pp. 35-36. Petrograd, 1916.

I) *Secale cereale* L. — *Tilletia secalis* Künn has only been reported on one farm in the district of Aleksin, where 20 per cent. of the plants were infected. *Urocystis occulta* Rabh. appeared almost everywhere to a lesser or greater extent from the 25th May, when it was first reported in the district of Odoïev. *Claviceps purpurea* Tul. made its appearance, on the 15th July, in the district of Tula, but it spread very little, and did not occasion damage of any extent. *Puccina graminis* Pers. was rather rare. On the other hand, *P. dispersa* Eriks. and Henn. was a little more frequent, especially in the districts of Tula and Novossil. *Fusarium roseum* and *F. metachroum* Appel and Woll. developed considerably, being favoured by abundant rains.

II) *Avena sativa* L. — *Ustilago avenae* Jens. and *U. levis* Magn. caused a crop reduction of 5 to 10 per cent. *Puccinia graminis* Pers. and *P. coronifera* Kleb. occurred to a very limited extent and *Septoria avenae* was observed within areas of small extent in the district of Tula.

III) *Triticum vulgare* L. — *Tilletia tritici* Wint. broke out in the districts of Aleksin, Tula and Tchern in localities where seed from the government of Kiev (where the disease is widespread) had been sown. *Ustilago tritici* Jens. and *Puccinia triticina* Eriks. and Henn. were fairly frequent and widespread. *Septoria tritici* Desm. was reported only once, in July, on a farm in the district of Aleksin.

IV) *Hordeum vulgare* L. — *Ustilago jensenii* Brefeld was reported in the district of Aleksin. *U. hordei* Brefeld reduced the crop of wheat by 3 per cent. *Puccinia simplex* developed to an extraordinary extent, so that hardly a leaf escaped.

V) *Panicum miliaceum* L. was attacked by *Ustilago panici-miliacei* Wint.

VI) *Trifolium* spp. — The following are to be recorded : *Uromyces trifolii* Lev., on *Trifolium repens* and *T. hybridum* ; *Erysiphe polygoni* D. C. on *T. alpestre* L. and *T. medium* L. ; *Peronospora trifoliorum* D. B. on *T. alpestre* in the district of Aleksin, and on *T. pratense* in the district of Tula ; *Cuscuta trifolii* was observed on the 3rd July in the district of Aleksin ; *Gloeosporium caulivorum* Kirchn., which spreads more and more and does greater injury every year ; *Phyllachora trifolii* Fuck. ; *Phyllosticta trifolii* Rich. ; *Ascochyta trifolii* Bond. et Trus. ; *Septoria compta* Sacc. and *Oedocephalum anthophilum* Jacz., a new disease of the flowers of red clover.

VII) *Medicago sativa* L. was attacked by *Erysiphe polygoni* D. C., *Peronospora trifoliorum* D. B., *Ascochyta medicaginis* Fuck. and *Pseudopeziza trifolii* Fuck., form *Medicaginis*.

VIII) *Vicia sativa* L. — *Septoria viciae* Westend in the district of Tula, on the 14th August.

IX) *Pisum sativum* L. – *Uromyces pisi* D. B. and *Ascochyta pisi* Lib.

X) *Melilotus albus* L. — *Erysiphe polygoni* D. C. and *Ascochyta meliloti* N. Trus. n. sp.

XI) *Fagopyrum esculentum* Moench. — *Ascochyta fagopyri* Bres. var. *tulensis* A. Bond. in the districts of Aleksin, Bogorod, Tula and Efremov.

XII) *Triticum repens* L. — *Epichloë typhina* Tul. and *Tilletia striaeformis* West.

XIII) *Bromus inermis* L. — *Puccinia bromina* Eriks., *Claviceps purpurea* Tul., *Tilletia striaeformis* West., and *Septoria affinis* Sacc.

XIV) *Dactylis glomerata* L. — *Epichloë typhina* Tul. and *Tilletia striaeformis* West.

XV) *Poa* spp. — *Puccinia poarum* Nielsen and *Sclerotium rhizodes*: the latter attacks the leaves, which gradually wither and die; many sclerotia then appear on the dead parts of the plants.

XVI) *Solanum tuberosum* L. — *Phytophthora infestans* De Bary, favoured by wet weather, broke out with great violence; it caused a loss of crop of over 50 per cent.

XVII) *Solanum lycopersicum* L. — *Macrosporium lycopersicum* Plowr. occurred rather frequently in the districts of Tula, Odioev and Aleksin.

XVIII) *Brassica oleracea* L. — *Ascochyta brassicae* Thüm.; *Plasmodiophora brassicae* Wor. did great damage. According to particulars supplied by the School of Agriculture of Bogoroditzk, the varieties " Bruxelles ", " Krasnokociannaia ", " Savoiskaia ", " Erfurth " late and early, and " Bronka " remain free; on the other hand, " Kolomenka ", " Ulmskaia Pudovaia " and " Braunschweig " were attacked to the extent of 5, 30 and 80 per cent respectively.

XIX) *Phaseolus vulgaris* L. — *Ascochyta boltshauseri* Sacc.

XX) *Cucumis sativus* L. — *Scolecotrichum melophthorum* Prill. et Delacr.; *Gloeosporium lagenarium* Sacc. broke out violently on young plants just transplanted, causing great damage. Good results were obtained by applying Bordeaux mixture; *Cercospora melonis* and *Fusarium lagenarium* Pers.

XXI) *Allium cepa* L. — *Peronospora schleideni* Unger and *Sclerotinia libertiana* Fuck.; the latter produced rot of the bulbs.

XXII) *Spinacia oleracea* L. — Considerably damaged by *Vermicularia herbarum* West.

XXIII) *Beta vulgaris* L. — *Cercospora beticola* Sacc. in the districts of Bogoroditzk and Aleksin.

XXIV) *Daucus carota* L. — *Sclerotinia libertiana* Fuck. causes rot of the roots which afterwards become covered with a whitish felt in which the sclerotia develop.

XXV) *Humulus lupulus* L. — *Sphaerotheca humuli* Burr.

XXVI) *Cannabis sativa* L. — *Phyllosticta cannabis* Speg.

XXVII) *Pirus malus* L. — *Phyllosticta briardi* Sacc.: apple trees in

some localities were attacked with such virulence that they lost a large proportion of their foliage in the heart of the summer; *Sphaeropsis pseudodiplodia* Delacr.; *Gymnosporangium tremelloides* R. Hartig; *Venturia inaequalis* Aderh. and *Sclerotinia fructigena* Schr.

XXVIII) *Pirus communis* L. — *Gymnosporangium sabinae* Winter.; *Mycosphaerella sentina* Fuck.; *Venturia pirina* Aderhold; *Sclerotinia fructigena* Schr. and *Entomosporium mespili* Jacz.

XXIX) *Prunus domestica* L. — *Phyllosticta prunicola* Sacc., *Puccinia pruni-spinosae* Pers. and *Exoascus pruni* Fuck.

XXX) *Prunus cerasus* L. — *Taphrina minor* Sad. in the districts of Aleksin and Bielew. *Clasterosporium carpophilum* Aderh. caused extensive damage in the government of Tula: reddish blotches appear on the leaves; they extend and join up, sometimes occupying a large portion of the surface of the leaf, the tissue of which dries and falls at the points attacked. This *Clasterosporium* also attacks fruits, the pulp of which is then rendered useless and partly dries away.

XXXI) *Ribes grossularia* L. — *Sphaerotheca mors-uvae* Berk and Curtis, and *Puccinia pringsheimiana* Kleb.

XXXII) *Ribes nigrum* L. — *Cronartium ribicolum* Dietrich and *Septoria ribis* Desm.

XXXIII) *Ribes rubrum* L. — *Pseudopeziza ribis* Kleb.

XXXIV) *Fragaria* spp. — *Septoria fragariae* Desm., *Ramularia tulasnei* Sacc., *Marssonia potentillae* Fisch. subsp. *fragariae* Sacc.

XXXV) *Rubus idaeus* L. — *Phragmidium rubi-idaei* Winter and *Septoria rubi* West.

XXXVI) *Rosa* spp. — *Phragmidium subcorticium* Winter, *Sphaerotheca pannosa* Lev., *Actinonema rosae* Fr. and *Monochaetia depazeoides* Otth.

XXXVII) *Paeonia officinalis* L. — *Cronartium asclepiadeum* Fries.

XXXVIII) *Sorbus aucuparia* L. — *Gymnosporangium juniperinum* Winter and *Sclerotinia aucupariae* Ludw.

XXXIX) *Crataegus oxyacantha* L. — *Podosphaera oxyacanthae* D. B. and *Ascochyta crataegicola* Allesch.

XL) *Rhamnus frangula* L. — *Microsphaera alni* Winter var. *divaricata* Wallr. and *Puccinia cronata* Corda on a large scale in the forests of Novosil.

XLI) *Rhamnus cathartica* L. — *Puccinia coronifera* Kleb. *Ascochyta frangulina* Kab. and *Phyllostica cathartici* Sacc. along the banks of the Oupa.

XLII) *Caragana arborescens* L. — *Uromyces genistae-tinctoriae* Winter; *Septoria caraganae* Henn.; *Phyllosticta spaethiana* Allesch. and *Ascochyta borjomi* Bond.

XLIII) *Conicera xylosteum* L. — *Leptothyrium periclymeni* Sacc.

XLIV) *Sambucus racemosa* L. — *Phyllosticta sambuci* Desm. and *Ascochyta syringae* Bres.

XLV) *Syringa vulgaris* L. — *Phyllosticta syringae* West., and *Ascochyta syringae* Bres.

XLVI) *Prunus padus* L. — *Exoascus pruni* Fuck. ; *Pucciniastrum padi* Ditel and *Polystigma ochraceum* Sacc.

XLVII) *Pinus sylvestris* L. — *Lophodermium pinastri* Chev. wrought serious havoc among young 4-year old plants in the nurseries of Bogoroditzk.

XLVIII) *Pinus strobus* L. — *Cronartium ribicola* Dietr.

XLIX) *Betula alba* L. — *Melampsoridium betulinum* Kleb. in the nurseries of Bogoroditzk, destroyed a large number of young plants 2 or 3-years old ; *Phyllactinia corylea* Karst. and *Sclerotinia betulae* Woron.

L) *Fraxinus* spp. — *Fusicladium fraxini* Aderh.

LI) *Acer* spp. — *Uncinula aceris* ; *Rhytisma acerinum* Fries ; *Exoascus confusus* Jacz.; *Taphrina polyspora* Sorok ; *Phyllosticta aceris* Sacc.

LII) *Ulmus* spp. — *Phyllosticta lacerans* Pass.

LIII) *Populus tremula* L. — *Melampsora populina* Jacz. ; *Gloeosporium tremulae* Pass. ; *Fusicladium radiosum* Lib. ; *Asteroma populorum* Sacc.

LIV) *Populus* spp. — *Taphrina aurea* Fries.

LV) *Salix* spp. — *Uncinula salicis* D. C., *Rhytisma salicinum* Fries, *Septoria santonensis* Passer.

LVI) *Tilia europea* L. — *Gloeosporium tilliae* Oudem. broke out with unusual violence and caused withering and fall of the foliage in the spring ; *Cercospora microsora* Sacc. attacked all the lime trees in several localities towards the second half of summer ; *Asteroma tiliae* Rud. and *Ectostroma tilliae* Fries.

LVII) *Quercus* spp. — *Oidium dubium* Jacz ; *Microstroma album* Sacc. ; *Septoria dubia* Sacc. ; *Phyllosticta quercicola* Oudem, and *Ascochyta dubia* Sacc.

689 – **Behaviour of Different Forms of *Rhizoctonia violacea*** (1). — Eriksson Jakob in *Arkiv für Botanik*, Vol. 14, Part 3, No. 12, pp. 1-31. Fig. 1-13. Stockholm, 1915.

*Rhizoctonia medicaginis* D. C. was first reported in Sweden in 1911 (in the island of Gothland) in a lucerne-field sown with seeds from Svalöf. Round the upper part of the root of the infested plants a violet-coloured mycelium develops, which may sometimes spread to the neighbouring parts of the stalk. The mycelial mass is not always of the same consistency; in some cases the hyphae form a loosely-woven texture, while in others they gather into a compact mass containing many sclerotia. These two forms of mycelium are clearly distinguished by the fact that perithecia only occur in the mycelia with loosely-woven hyphae. The perithecia are absent, on the other hand, when the hyphal tissue is very thick and provided with sclerotia. Their perithecia may be identified beyond all doubt with *Byssothecium circinans* (*Leptosphaeria circinans* Sacc.), a pyrenomycete discovered by Fuckel in 1861, and studied later by Prunet and Lüstner.

If *Leptosphaeria circinans* is in reality a stage in the development of *Rhizoctonia medicaginis*, any identity between the latter and the *Rhizoctonia* pest of beetroots is disposed of. *Rhizoctonia* infesting the beet in its peri-

(1) See also *B.* March 1912 No. 574 ; *B.* April 1913, No. 426 ; *B.* July 1913 pp. 1035-36; *B.* Jan. 1916 No. 123.

thecial stage exhibits a distinct form — *Hypochnus violaceus* — which is a hymenomycete.

*Rhizoctonia asparagi* Fuck. attacks the rootstock of asparagus and kills the plant. In bad cases the parenchyma of the root cortex is quickly destroyed, and nothing but the central ground-tissue and the periderm remain. In the cavity thus laid open, a dark brown mycelium with very thin hyphae and black sclerotia develops. On the other hand, no trace of perithecia is observable, as they are unable to develop at the depth where the asparagus roots spread.

Similarly, *Rhizoctonia violacea* of beetroots, *R. solani* and *R. medicaginis* only develop their forms *Hypochnus violaceus, H. solani* and *Leptosphaeria circinans* towards the upper part of the root or at the base of the stalk.

Are *Rhizoctonia medicaginis* and *R. asparagi* identical? What biological relation exists between these two fungi and other kindred forms?

Two plats, separated from the surrounding land by an underground wall to a depth of one metre, one of which was infected with *Rhizoctonia medicaginis*, and the other with *R. asparagi*, were sown with lucerne, red clover, turnips, sugar beet and forage beet.

In the plat containing the germs of *R. medicaginis* the lucerne alone was attacked. In that containing germs of *R. asparagi*, asparagus alone was infested. In both cases all the other plants were unharmed.

The results obtained are in conflict with the opinion which has long obtained, namely that the forms of mycelium known together under the name of *Rhizoctonia violacea* are identical, assuming that *R. medicaginis* can be derived from *R. asparagi*.

The writer several times tried to graft the *Rhizoctonia* of the beet on lucerne roots; the results obtained were always negative or the forms were quite harmless.

It is of course not impossible that the parasite characteristic of a certain plant and peculiar to it, may be able to live on another plant as well and cause a milder form of disease, without losing its individuality to any extent. Thus, in 1886, Rostrup met with the *Rhizoctonia* of red clover not only on *Trifolium hybridum, T. repens, Medicago sativa* and *M. lupulina*, but also on *Rumex crispus, Geranium pusillum, Fagus sylvatica, Oxyacantha, Ligustrum vulgare, Picea alba, Abies pectinata, Pinus laricio* and *P. montana*. Each given form of *Rhizoctonia*, however, could only develop as a true parasite and pest on a given plant: that of lucerne on lucerne, that of the beet on the beet, etc. They have adapted themselves to such an extent, and reached such a stage of evolution, that each of these forms may be regarded as possessing the standing of a " species ".

690 – **Relation of Stomatal Movement to Infection by *Cercospora beticola*.** — Pool Venus W. and Mokav M. B. in *Journal of Agricultural Research*, Vol. V, No. 22, pp. 1011-1038, Fig. 1-6, Plates LXXX-LXXXI. Washington, D. C., February 28, 1916.

The conidial germination tubes of *Cercospora beticola* Sacc. penetrate the stomata of the leaves of the sugar beet. They there develop a number of round cells in the chamber below the stomata, branching off towards

the cells of the parenchyma, and invading the intercellular spaces. The tissues of the host react and endeavour to isolate the infected parts by secreting special substances. This sometimes causes a stoppage of the pathological process, and the leaves continue to grow and develop regularly.

In the course of these experiments it was ascertained with certainty that the germ tubes can only enter through open stomata. Consequently, all conditions and factors promoting the opening of the stomata will have also a positive effect on inception of the infection. This, for instance, is true of the direct light of the sun, of rather high temperatures, of high relative humidity (never below 60°) and of leaf organs acting fully. In well-developed green leaves the stomata remain open almost all day, while the recently formed young leaves usually close at about 3 p. m., and in old leaves the stomata move seldom and tardily. It is owing to these conditions that the infection usually appears on the finest and most vigorous leaves, while the mature and the tender leaves grouped towards the apex of the plant generally remain immune.

691 – **Wintering of *Oidium* sp., a Pest of *Photinia serrulata* in Emilia, Italy.** — PEGLION V. in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*. Series 5, Vol. XXV, 1st Half-year, Part 5, pp. 341-342. Rome, March 5, 1916.

By these observations it is sought to ascertain whether the species of *Oidium* first observed at Ferrara and later at Bologna as a pest of *Photinia serrulata* should be included among the forms which winter in the buds. The writer did not find the perithecial form of the parasite which, in the conidial form, exhibits great analogy with *O. farinosum* (living on the apple tree and related to *Podosphaera leucotricha*), which is well known to occur widely in Emilia, and which winters in the conidial form in the buds of its host.

In the spring of 1915, a number of buds were seen to open and put forth shoots, all of which were covered with a thick layer of mycelium and which stood out among the uninjured buds. Some time passed before blotches of *Oidium* appeared scattered sporadically over the leaves of the buds previously free, and probably coming from the conidia disseminated by the infested shoots. This is the same process as that observed in the mode of infection of the *Oidium* of the oak, apple and rose.

In 1916, owing to the mild season, the buds of *P. serrulata* were ready to put out shoots as early as the second or third week in February. Observation of some specimens showed a striking difference in development of buds in the same individual. Microscopical examination proved that the most advanced buds were healthy. The most backward ones, still unopened and poorly filled out, were all found to be infested with *Oidium* when cut. The mycelium covers the inside face of the protective scales with an abundance of conidiophores, but it attains its maximum development on the growing point and the rudimentary leaves. On forcing the plant in the incubator the shoots open out rapidly and are seen to be all infested in a characteristic way by the parasite.

This new example of wintering in the vegetative form, which must

be added to the many cases disclosed by the study of the Erysiphaceae, confirms the frequency in nature of close adaptation of the life cycle of the parasite to the vegetative conditions of the host. So frequently is this the case that it reduces the importance of the part played by evolved fructifications (perithecia, oospores and chlamydospores) as compared with the vegetative apparatus and the agamic fructifications, in relation to the preservation of the species during adverse seasons, or while the host is resting. These biological features, moreover, may furnish useful suggestions for practical methods of control.

692 - **The Life History of *Exoascus deformans* (Peach-leaf Curl) and Preventive Treatment.** — PEGLION V. in *Le Stazioni Sperimentali agrarie italiane*, Vol. XLIX Parts 3-4, pp. 200-218. Modena, 1916.

The results are here set out of ten years' observations in Emilia, Italy, taking into account the studies published by other writers during that time.

*Propagation of Exoascus deformans.* — A). *Perennial mycelium.* According to Pierce (" Peach Leaf Curl : its Nature and Treatment ", Bull. No. 20, U. S. Department of Agriculture, Veg. Path. and Phys., 1900) " it seems likely that the small twigs bearing deformations visible to the naked eye are the true and only focus of the perennial mycelium and everywhere form the sole source of spring infection due to the wintering hypha, the only source of infection which is not reached by spraying ".

The writer found that in Emilia, small twigs attacked while still young by *Exoascus*, as well as shoots infected at the time of opening of the bud, do not survive the winter ; he never succeeded in finding the disease present as a hibernating mycelium in shoots entirely at rest. It follows that, from the practical point of view, the perennial mycelium of *Exoascus* plays an insignificant part in the preservation and propagation of the parasite either owing to the very limited number of foci of infection or to the fact that the infection due to the perennial mycelium is confined to the young shoots which undergo almost the same effect as when infected by the spores.

B) *Propagation by Ascospores.* — " As a single spraying suffices to prevent the disease in 90-98 per cent of the cases, it may be assumed that this percentage represents the infection produced by the spores ". This deduction made by Pierce still remains hypothetical, as there is no direct confirmation and experimental demonstration of the process of infection.

All endeavours to solve this problem are rendered hopeless by the impossibility of inducing the growth of *E. deformans* in artificial media or studying it in combination with other fungi with which it is associated under natural conditions. The writers' trials were also negative in result. He had occasion to observe that *E. deformans* is a comparatively cold-loving organism, which is in keeping with the fact that the epidemic breaks out when sudden cold spells occur at the beginning of vegetation of the peach. Under the conditions existing in Emilia, periods of fog accompanied by abundant and persistent dew are chiefly to be feared.

*Means of Control.* When urgent action is called for, the writer advises the following comparatively concentrated solution, which is prompt

in action owing to the ammoniated copper remaining in solution, which, on the evaporation of the ammonia, leaves behind a deposit of readily soluble oxyhydrate of copper. It is sufficiently adhesive and possesses remarkable reserve powers in the shape of copper compounds which act in succession. Ammonium chloride may be replaced by ammonium sulphate. The mixture has already been practically applied with good results :

| | lbs |
|---|---|
| Sulphate of copper | 2 |
| Quicklime | 1 |
| Ammonium chloride | 0.200 |
| Water | 100 |

Several Italian agricultural journals have suggested the use of solutions with 3 or 4 per cent of sulphate of copper, but the writer thinks 2 per cent sufficient, it being more advantageous to repeat the sprayings during the period of rest than to increase their concentration.

In cases where, as happens in Romagna, the peach tree is attacked by *Diaspis pentagona*, as well as by *E. deformans*, the lime-copper solution should be replaced by lime-sulphur solution.

When spraying, the utmost care must be taken to reach all the buds ; the operation must be done in good time, that is, before the flower buds begin to swell.

MEANS OF PREVENTION AND CONTROL

693 - **Action of Copper Sulphate on Vine Mildew.** — SEMICHON in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. II, No. 11, pp. 372-384. Paris, March 1916.

The final action of sulphate of copper is explained by two facts : 1) the surplus copper sulphate remaining on the leaves is partly soluble in atmospheric water, and when dissolved it kills the zoospores of the mildew, which have multiplied in consequence of the rain. According to MILLARDET, 2 or 3 tenths of a mgm of copper per litre are sufficient for that purpose ; 2) a part of the copper is directly absorbed by the tissues, which are thus immunised.

The author proposed, by a series of experiments : 1) to elucidate the cause of the frequent and considerable variations observed in the length of time for which sulphate of copper remained effective after application ; 2) to measure the action of the copper absorbed, at the same time studying the conditions under which absorption takes place.

*Surplus Copper Sulphate.* — The greater the length of time expired since application, the less is the quantity of soluble copper remaining. With a rainfall of 20 mm. the observations are :

| | mm. of copper per litre |
|---|---|
| After 2 days | 4.5 |
| 6 | 1.2 |
| 10 | 0.8 |
| 15 | 0.5 |
| 20 | 0.3 |

There has been much discussion as to the relative value of Bordeaux and Burgundy mixture, acid, neutral or basic preparations, plain solutions, copper and ammonia liquids, etc. without any account being taken of the most important factor, namely, the curve of insolubility of the deposits, ascertaining its variations according to the different composition and preparation of the mixtures. To secure good practical results the residue should not be too soluble, otherwise the first rain dissolves it and washes it away to a large extent. Again, it must not be too insoluble, as in that case even plentiful rain would not suffice to dissolve the quantity required for a fatal dose.

As already stated, two or three tenths of a milligram are sufficient, according to MILLARDET, to destroy the zoospores of the fungus ; in reality, however, the quantity of copper needed increases with the number of zoospores, and in cases of very severe infection the Author detected live zoospores in solutions containing 2.8 mm. of copper per litre. Under given conditions, therefore, the action of the surplus sulphate comes to an end three or four days after the application. Under other circumstances again, i. e. when the number of zoospores is rather low, this action may last more than twenty days. This is the cause of the great variations observable in the length of time during which the surplus copper remains effective.

*Copper absorbed* : 1) When it has made its way in, the soluble copper can circulate through the tissues with the sap.

2) It has been observed that plain solutions of sulphate of copper often cause burns on the leaves, chiefly towards the edges, which turn black. These leaves contain absorbed copper and are immunised. Copper can therefore be absorbed as a result of traumatism.

3) When a sudden fall in temperature stops the upward movement of the sap and the development of the foliage and branches in spring or summer, the plant passes into a period termed " period of receptivity ". The tissues are at that moment particularly adapted for absorbing copper. Having measured the quantity of copper absorbed during a period of strong uninterrupted growth and a period of suspended activity, the writer found 16 mm. and 71 mm. per kilogram of foliage.

*Practical Applications.* — 1) The copper immunises the vine. It is serviceable above all in those cases where the action of surplus copper is inadequate.

2) In both cases soluble copper alone should be taken into consideration, as it is the only form acting against the zoospores and capable of absorption by the tissues, with resulting immunisation. These facts suggest the desirability of reverting to the use of plain solutions of sulphate of copper and powders containing soluble copper.

3) Better results would be obtained : *a*) by using liquids containing soluble copper instead of the mixtures in which the whole of the copper is precipitated in the form of flakes of hydrate or hydrocarbonate of copper ; *b*) by spraying during the period of receptivity.

4) The use of powders containing soluble copper is particularly advisable in June and July, at the time when the dews are so favourable

to the growth of the mildew. The dew dissolves the copper, which acts directly against the zoospores and is even absorbed by the tissues.

5) It is well known that the mildew is propagated from year to year by means of the winter spores which form on the mosaic-like network of spots, characteristic of autumn attacks. The more virulent these spots the more serious would be the outbreak in spring. Hence the importance of a thorough autumn application of a simple solution of sulphate of copper which, being absorbed by the tissues, would arrest the function of the winter spores.

DISEASES OF VARIOUS CROPS

694 - **A New Disease of Germinating Wheat caused by *Podosporiella* sp., in Salt Lake Valley.** — O' GARA P. J., in *Science*, New Series, Vol. XLII, No. 1079, pp. 313-314. Lancaster, Pa., 1915.

The writer, on visiting some areas of land under wheat in Salt Lake Valley (Utah) in 1915, was struck by the irregular growth of the young plants, some of which were stunted and defective. In the previous year, wheat had been infested in the same localities by the wheat-straw worm (*Isosoma grande* Riley), so that the first thought was to attribute the abnormal condition of the young plants to the action of the larvae of this parasite. A careful examination of the backward specimens, however, disclosed the presence of a fungus infesting the grains, partly destroying them and causing deterioration of their contents at the time of germination.

According to the writer, the pathogenic agent is a new species of the genus *Podosporiella*, which he proposes to study and describe at an early date.

695 - ***Bacillus Sorghi* on *Andropogon Sorghum* in Salt Lake Valley, Utah.** — O' GARA P. J. in *Science*, New Series, Vol. XLII, No. 1079, pp. 314-315. Lancaster, Pa., 1915.

The writer observed that some Sudan grass plants (*Andropogon sorghum*) recently imported into Utah, were infested with a bacterial disease due to *Bacillus sorghi* Burr.

On the leaves, elongated blisters are observed, ruddy brown in colour and very numerous, which cause the leaves attacked to wither and die.

In 1915, the outbreak of this disease was certainly due to the rains and persistent wet weather in the month of May. Normally it should not form a serious obstacle to the cultivation of this forage plant.

696 - **Sweet Potato Diseases in the United States.** — HARTER L. L. in *United States Department of Agriculture, Farmer's Bulletin* 714, 26 pp., 21 Fig. Washington, D. C., March 11, 1916.

In addition to many large centres in the South of the United States where sweet potatoes form the principal market crop, the industry has been intensely developed in one or two sections in the States of New Jersey, Delaware, Ohio, Illinois, Iowa and Kansas. This industry could be very much extended if the grower experienced no difficulty in storing the potatoes until the winter, when they fetch a much higher price. The trouble, however, is not only to find good methods of storage. The sweet potato is

attacked in the field by various fungus diseases, the principal of which are : black rot (*Sphaeronema fimbriatum*), stem rot (*Fusarium Batatatis* and *F. hyperoxyporum*) (1) and foot rot (*Plenodomus destruens*) (2). The first of these diseases occasions heavy losses even in storage, where it rapidly develops. The second does not itself cause large storage losses, but may pave the way for other organisms producing rot.

A description is given of the different diseases attacking the sweet potato both in the field and in storage, with advice on the methods of control so far as known at present. These diseases and control methods are as follows :

*Diseases of the Roots and Stems.* — Stem-rot (*Fusarium Batatatis* and *F. hyperoxysporum*). — The seed potatoes should be disinfected by treating for 5 to 10 minutes in a solution made by dissolving 1 ounce of corrosive sublimate in 8 gallons of water. The hotbeds should be disinfected with a solution of formaldehyde or sulphate of copper, and the soil for the hotbed obtained from some place where sweet potatoes have never been grown. The farm utensils should be sterilised, healthy seeds used, and suitable crop rotations applied. The same means are used for controlling black rot (*Sphaeronema fimbriatum*), foot-rot (*Plenodomus destruens*), scurf (*Monilochaetes infuscans*) (3), (a very widespread disease attacking all varieties of sweet potatoes, and promoted by moist earth rich in organic matter), and root rot (*Ozonium omnivorum*), which attacks many plants both cultivated and wild : against this last disease deep and clean cultivation and aeration of the soil are important.

*Leaf Diseases.* — Leaf-blight (*Phyllosticta Batatas*), leaf-spot (*Septoria bataticola*) and white-rust (*Albugo Ipomaeae-panduranae*) (4), though occurring widely in the Southern States of the Union, have never caused such damage as to compel control measures.

Storage diseases of sweet potatoes are (in the order of their injuriousness) : soft-rot and ring-rot (*Rhizopus nigricans*) ; black-rot (*Sphaeronema fimbriatum*) ; dry-rot (*Diaporthe Batatatis*) (5) ; Java black rot (*Diplodia tubericola*) ; and charcoal rot (*Sclerotium bataticola*). To prevent them, the tubers must be lifted as late as possible but before frosts, taking care not to injure them, The writer advises that they should be well dried in the field, and hauled to the storage house in open crates holding about a bushel, leaving them in the crate for storage. The storage house must be kept at a temperature of 80 to 85° F. during the first days of storage in order to help to drive off surface moisture ; it is then gradually lowered to about 50 to 55° Fahrenheit and maintained at this during the storage period. It is also essential to keep the storage house dry and well aired. Before storing

(1) See also *B.* July 1914, No. 687. (*Ed.*)
(2) » » » May 1914, » 482. »
(3) » » » May 1916, » 580. »
(4) » » » Sept. 1913, » 1104. »
(5) » » » May 1916, » 580. »

the new crop the storage house must be disinfected with a solution of formalin or sulphate of copper or winter-strength lime sulphur solution, or by whitewashing.

697 - **Soilstain or Scurf (*Monilochaetes infuscans*) of the Sweet Potato** (1). — TAUBENHAUS J. J. in *Journal of Agricultural Research*, Vol V. No. 21, pp. 995-1001, Pl. LXXVII, Washington, D. C., February 21, 1916.

Results of a series of investigations during a period of 3 years, in Delaware, in relation to disease of the underground parts of the sweet potato (*Ipomoea Batatas*) commonly called "soilstain" or "scurf".

The fungus causing the disease, *Monilochaetes infuscans* E. et H., may influence not only the quality but also the quantity of the crop, by attacking the rootlets of the plant and preventing normal growth of the latter. The resulting loss may amount to as much as 10 %.

After numerous unsuccessful endeavours, the pathogenic agent was isolated, and was found not to begin to grow in culture-media until after 3 weeks. This tardiness of development explains the difficulties encountered in identifying the organism and isolating it from the abundant flora and very varied micro-organisms, which over-run and conceal everything.

The fungus in question will also grow on sugar and starch media. There it is not these substances which, as was hitherto believed, prevent the pathogenic agent from penetrating the tissues under the epidermis ; the inhibitory action must certainly be attributed to special enzymes secreted by the host.

The Author undertook a number of experiments with the object of studying the disease in tubers under storage ; he arrived at the following conclusions :

1) Really healthy roots continue healthy even when originating from infected fields ;

2) On the other hand, in slightly infected roots, the disease takes its normal course ; the small spots spread and unite ;

3) The diseased roots dry and shrink very rapidly ;

4) Healthy roots can contract the disease if brought into contact with infected substances ;

5) The development of the disease is promoted by storage of the roots in damp, badly ventilated places.

With regard to the morphology, it is found that the conidial spores are borne above the mycelium, the oldest part of which also becomes dark in hue. The conidia form in chains which break off as soon as moistened or disturbed.

698 - ***Phytophthora* Disease of Ginseng.** — ROSENBAUM JOSEPH in *Cornell University Agricultural Experiment Station of the New York College of Agriculture, Bulletin* No. 363, pp. 65-106, Figs 2-18. Ithaca, New York, 1915.

The American ginseng, *Panax quinquefolium* L., was brought under cultivation about 20 years ago but either the same or a closely related species

(1) See also *B.* May 1916, No. 580.

has been cultivated in Korea for more than two centuries. Three factors are favourable to its growth, namely, shade, good drainage and an acid soil. The failure of the grower to take these factors into consideration is primarily responsible for most of his losses with this crop.

The Phytophthora disease of ginseng (*Phytophthora Cactorum* [Cohn and Leb] Schröt) probably exists in every State in which ginseng is grown — Washington, Oregon, Nebraska, Kansas, Minnesota, Missouri, Arkansas, Wisconsin, Michigan, Indiana, Ohio, New York, Pennsylvania, New Jersey and Maryland. It also causes a large amount of damage in Japan.

The symptoms of the disease are as follows : Usually there is a drooping of a single one or all of the leaflets at the top of the petiole. In many cases the disease attacks the main stem at the crown, or point where the leaf petioles are attached, and all the leaves droop and hang limp from the top of the stem.

The leaf blades show dark green, water soaked spots. A week or two after the first appearance of the spot, the centre becomes white, the margins remaining a dark green. The spots vary in size from one centimeter in diameter to lesions involving the entire leaf. If the weather is wet and cloudy the disease spread rapidly down the stem, hollowing it out. The roots may also be attacked, showing a semi-soft rot.

In certain cases the disease starts by attacking the roots, subsequently spreading to the stem and leaves which turn yellow or brown. These symptoms, however, are common to several other diseases of ginseng, *e. g.* those due to *Alternaria panax* Whetzel (1), *Sclerotinia libertiana* Fckl., *S. panacis* Rankin, *Acrostalagmus* sp., *Fusarium* sp. Microscopical examination is therefore necessary for definite identification.

The writer's researches were concerned with the following : isolation of the fungus, various inoculation experiments with the mycelium, conidia and oospores in the stem or roots (positive results were obtained throughout); the comparative examination of *Phyt. Cactorum* isolated from ginseng with that isolated from *Phyllocactus* (the author concludes that the species are identical but considerable variations may be exhibited); the life cycle ; the morphology of the fungus.

The methods of control are as follows :

1) Spraying with Bordeaux mixture 3-3-50, to which has been added 2 lbs. of arsenate of lead for every 50 galls. of mixture The fungicide should be applied as soon as the plants are pushing through the soil, and the application should be continued at intervals until all the plants have made their appearance. Spraying after this period will depend on weather conditions and on the amount of growth that the plants have made since the last application. Spraying should be done before rainy periods, and all the new growth should be covered.

(3) Removal of diseased parts.

(3) Deep planting, in such a way that the roots are at least 4 inches below the surface of the soil.

(1) See also *B.* Feb. 1916, No. 248. (*Ed.*)

(4) Rotation with crops immune from *Phytophthora* and which require the same conditions of shade. « Golden seal " (*Hydrastis canadensis*) is a good plan for the purpose.

(5) Soil sterilisation by means of steam under a pressure of from 75 to 100 lbs. for a period of time varying from 20 to 40 minutes, according to nature of soil.

(6) Drainage.

Appended to the paper is a list of 20 publications.

699 - ***Thielavia basicola*, a new Pest of the Melon in Salt Lake Valley, Utah.** — O' GARA P. J. in *Science*, New Series, Vol. XLII, No. 1079, p. 314, Lancaster, Pa., 1915.

In 1915, in Salt Lake Valley, all the plants of a field of melons (*Citrullus vulgaris* Schrad.) perished, and a second plantation also suffered enormously. Many plants which had started to grow in an apparently normal way, withered and dried away after a time. Such few as did attain any development were stunted and chlorotic in appearance. On examining these the writer found that the root-stock had been destroyed ; lateral rootlets had formed subsequently above the point attacked.

The diseased tissues were infested with the fungus *Thielavia basicola* (B. et Br.) Zopf, which was successfully isolated in pure cultures and produced its characteristic fructifications. This is said to be the first time the melon has been included among the hosts of this member of the Perisporiaceae.

700 - **An *Oidium* Mildew on Carnations, in England.** — MERCER W. B,, in *The Journal of the Royal Horticultural Society*, Vol. XLI, Part 2, pp. 227-229, Fig. 80. London, 1915.

Description of a disease which suddenly broke out in the greenhouses of a garden in the Tyne valley in the early summer of 1914. It is due to an unidentified member of the Erysiphaceae. On the leaves and sepals patches of white mould appear, which gradually spread and eventually assume a yellowish hue. The mycelium forms a weft of threads over the surface of the infected parts and whose branches are closely applied to the epidermal wall. The haustoria, which are fine and thread-like, bore their way through the cuticle and penetrate into an epidermal cell, where they become greatly distended, the cell cavity in some cases being almost entirely filled. " Lady Alington ", " Bridesmaid " and " British Triumph " are the varieties which suffered most from this fungus. The parasite produces long, colourless chains of conidia, which break off and spread with great facility, propagating the disease. Owing to the absence of perithecia the species could not be identified.

The following mixture gave excellent results : 1 ¼ lb. crystallized copper sulphate, 1 quart of strong ammonia, 2 ½ gallons of water. Half a pint of this mixture diluted to 4 gallons with water before use.

701 – ***Pleospora Briosiana, Phomopsis Cocculi, Macrophoma Yuccae* and *M. Cinnamomi-glanduliferi*, new Micromycetes discovered in Liguria, Italy.** — MAFFEI LUIGI in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Series 5, Vol. XXV, 1st Half-year, Part V, pp. 339-341 Rome, March 1916.

Continuing his investigations on the mycology of Liguria, the writer describes the following four new species :

1) *Pleospora Briosiana* n. sp. was observed in 1915 at Chiavari, where it attacks the foliage of *Bignonia buccinatoria*, producing blotches of irregular shape. In many leaves the infection starts at the apex and spreads towards the base, involving a large area of leaf. In others it is confined to the edges but is still of some extent. The blotches are hazel-coloured, with black borders shading off.

2) *Phomopsis Cocculi* n. sp. was likewise met with at Chiavari in 1915. The leaves of *Coccolus laurifolius* attacked by this micromycete show light ashy spots, irregularly bordered with black, shaded with hazel. The spots usually occur at the end of the leaf, involving about one-third of the latter. On the spots the fructifications of the fungus are observable, which develop on both faces.

3) *Macrophoma Yuccae* n. sp. was observed in 1915 at Nervi, on foliage of *Yucca gloriosa*. The fructifications develop within ill-defined patches surrounded with a dark border.

(4) *M. Cinnamomi-glanduliferi* n. sp. was discovered, in 1915, at Chiavari and Sarzana on leaves of *Cinnamomum glanduliferum*. It forms large hazel blotches, more or less pronounced, with a border of darker colour. The attack of the parasite reduced the majority of the infested plants to a wretched condition.

702 – **Brown Rot (*Sclerotinia cinerea*) of Prunes and Cherries in the North-West Region of the United States** (1). — BROOKS CHARLES and FISHER D. F., in *United States Department of Agriculture, Bulletin* No. 368, pp. 1-10, Pl. I-III Washington D. C. March 6, 1916.

For several years the growers of the Lower Columbia and Willamette Valleys have had severe losses of their prunes and cherries, owing to the dropping of the bloom and young fruit. Mr M. B. WAITE, Pathologist in charge of Fruit-Disease Investigations (Dept. of Agriculture, U. S. A.) examined some diseased prune blossoms sent him, and found them to be infected with the ordinary brown-rot fungus (*Sclerotinia cinerea* [Bon.] Wor.), the conidial form of which (*Monilia*) had attacked the bloom in various stages, killing some of the buds before they had opened, often penetrating the entire flower and extending down the pedicel. Some of the blossoms had set their fruit, and the young prune had started to develop before the flower was completely killed. In other cases the young fruits were penetrated. In others again they were not yet penetrated by the fungus, which had partly killed the flower and spread down the pedicel. The conidial form of the fungus was fruiting abundantly over most of the surface of the diseased organs.

(1) See also *B.* August 1914, No. 788. (*Ed.*)

In 1915 the study of the disease was continued at Vancouver, Washington, with the following results :

In some years the brown rot problem is one of great importance to the prune industry in the more humid sections of the North-West of the United States. It has been shown that the apothecia which developed from fallen prunes are the probable source of the blossom infection. The appearance of the apothecia and infection of the former are simultaneous. The conidial form has never been found on fallen fruit. Autumn ploughing and early spring cultivation, ahead of the blossoming period, have apparently helped to prevent the disease by interfering with the development of the apothecia. The wind is probable the most important agent in spreading the spores. Insects may be concerned in this distribution, but are chiefly important owing to the punctures they produce on the fruit, furnishing an entrance point for the fungus. Among the insects, the fruit tree leaf syneta (*Syneta albida* Leconte) is probably of importance, as it was present in great numbers during the early part of the season, feeding on both fruit and foliage and causing much damage.

Though the early applications of spraying were washed off, showing the importance of adding a sticker, even with rather unsatisfactory conditions spraying has given fairly good results. The plats given both early and late spraying with self-boiled lime-sulphur set from 1 to 5 times as much fruit as unsprayed ones, gave 2 $^1/_2$ times as large a yield and had only $^1/_9$ of the total brown rot on the harvested and $^1/_8$ on the stored prunes. Self-boiled lime-sulphur and Bordeaux mixture have both given good results, but the former has seemed somewhat more satisfactory.

The sticking and spreading qualities are greatly improved by the addition of 2 pounds of resin fish oil soap to each 50 gallons of mixture. On the basis of experience up to the present time the following schedule of spraying may be suggested :

The first application just before the blossoms opened, the second just after the petals have fallen, a third 3 to 4 weeks later, a fourth about 4 weeks before harvesting. In 1915 the first and fourth sprayings were particularly important.

Observations made near Vancouver, Washington, and in the vicinity of Salem (Oregon) in the spring of 1915 showed that there had also been a blossom infection of cherries. Spraying trials were made (on the 7th and 8th May and 1st June) with Bordeaux mixture and lime-sulphur solution with or without resin fish-oil soap. Part of the fruit from each plant was packed and placed in cold storage, being afterwards shipped. The trials were begun too late to be of any decisive value. They nevertheless prove that late spraying with Bordeaux mixture or self boiled lime-sulphur greatly reduces the loss of stored fruit. Probably a similar treatment to that of prune trees applied to the cherry trees would effectively control the infection both of the blossoms and fruits.

703 - **An Asiatic Species of *Gymnosporangium*, established in Oregon** (1). — JACKSON H. S., in *Journal of Agricultural Research*, Vol. V, No. 22, pp. 1003-1009, Pl. LXXVIII-LXXIX. Washington, D. C., February 28, 1916.

In June 1914, the Author observed, at Orient, in the environs of Portland, Oregon, two Japanese pear trees (*Pirus sinensis*) the foliage of which was seriously infected with a species of *Roestelia koreaensis*.

So far as known, all species of *Roestelia* are the aecidial stages of species of *Gymnosporangium*.

In March 1915, in the above locality, within twenty feet of the two Japanese pear trees, the Author found some specimens of *Juniperus chinensis* with foliage abundantly infected with the telial stage of *Gymnosporangium* which was identified as *G. Haraeanum* (=*G. koreaense*).

With branches of infected juniper the Author communicated the disease artificially to potted specimens of *P. sinensis* and *Cydonia vulgaris*. The aecidia collected from *P. sinensis* and *C. vulgaris* agreed in all respects with *R. koreaensis*.

Little is known concerning the economic status of this fungus. Other species of *Gymnosporangium* already established in America caused considerable damage, for instance *G. Juniperi-virginianae* Schw. in the eastern States and *G. Blasdaleanum* (D. et H.) Kern in the Pacific States.

The aecidial form of the *G. Haraeanum*, as stated, develops on *P. sinensis* and *C. vulgaris*, but very probably it might spread to other species of pomaceous trees, just as *G. Haraeanum* might at any time find a favourable environment in the American species of juniper, and thus become definitely established in America.

## WEEDS AND PARASITIC FLOWERING PLANTS.

704 - **Investigations in 1914, on the Weeds occurring in the Government of Kherson, Russia.** — PACZOSKY I. in *Труды Бюро по прикладной Ботанике* (Studies of the Bureau of Applied Botany), Year VIII, Vol. 6, (80), pp. 816-820. Petrograd, 1915.

The Bureau of Applied Botany attached to the Ministry of Agriculture undertook: (1) to devise a method for the study of field weeds; (2) to study the root system of the weeds peculiar to the region.

A field of 610 sq. metres sown with oats and infested with wild oats was divided into 1206 equal parts (6.44 sq. ft. each) and the culms of the two plants in each were counted. The actual average of weeds was found to be equal to 17.15 culms per sq. ft.

A determination of the average based on various combinations of the number of plots (i. e. taking every fifth, every tenth, every twentieth, etc.) only furnishes results close to the real average when the number of plots is very large, which renders the method impracticable. Therefore the writer holds the view that the only practical method for determining the degree

(1) See also *B.* May 1914, No. 481. (*Ed.*).

to which a field is infested with weeds is to confine oneself to one or a few selected plots, after very careful observations of the actual conditions in the field.

With regard to the root system, it has been found that the roots of *Cirsium arvense* reach a depth of 20 ft; those of *Euphorbia virgata*, 9.84 ft; of *E. glariosa*, 8.53 ft; of *Centaurea scabiosa* and *Salvia nemorosa*, 7.22 ft; of *Reseda lutea* 9.18 ft and of *Melandrium album* 6.9 ft. It has also been observed that some weeds gain fresh vigour in consequence of cultivation (*Reseda lutea* and *Melandrium album*).

705 – **Experiments for Control of *Ranunculus arvensis*, a Weed infesting Wheat, in Touraine.** — MARTIN J. B. in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. II, No. 13, pp. 420-424. Paris, March 1916.

*Ranunculus arvensis* (known in Touraine as "picot", "pied-court" "pied coq") is one of the most injurious weeds of autumn wheat. It presents little danger in shallow, warm, sandy or limey soils, but is a redoubtable pest in the clayey soils of Touraine. In strong, cold soils, during wet winters, it can thrust its roots deep down and strengthen its stem, and the wheat, hindered by the excessive moisture in the soil, and depending for its development on the return of good weather, is choked by it. In 1911 and 1912 the writer observed wheat in the commune of Saint-Branchs which had been overrun and weakened to such an extent by the *Ranunculus* that it had to be cut green for forage.

The writer carried out control experiments, with results as follows:

1) Sulphate of copper, used alone, in the proportion of $4\,^1/_2$ lbs in 10 gallons of water, produced burns but did not kill the weed.

2) Sulphate of copper (9.9 lbs) and nitrate of soda (22 lbs) in 10 gallons of water killed or seriously injured 35 % to 40% of the weeds, and the wheat, strengthened by the nitrate, gained the upper hand.

3) Anhydrous sulphate of iron, at the rate of 624 lbs per acre gave the best result. More than 80 % of the weeds were destroyed entirely. It is advised that this remedy should be applied at the beginning of February.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

GENERALITIES

706 – **Two new British Coccidae and other British Species Injurious to Plants.** — GREEN ERNEST E. in *The Entomologist's Monthly Magazine*, Third Series, No 13 (No. 620), pp. 23-24, Fig. 1 and No. 14 (No 621), pp. 25-31. Fig. 2-4. London, January and February 1916.

A list of some coccids found in England, two of which are described as new species.

*Parafairmairia gracilis*, n. sp., on the leaves of various grasses and sedges at Camberley (Surrey).

*Lecanopsis longicornis*, n. sp. 3 specimens found on plots of grass at Camberley, July 1915.

*Gossyparia ulmi* Geoffroy, on a Cornish elm at Farnham (Surrey)

*Aspidiotus hederae* Vallot, a common greenhouse pest throughout the British Isles, infesting more particularly various kinds of palms, *Dracaena*, *Citrus* and oleander. It was also found in the open in April 1915, on the foliage of *Aucuba japonica* at Torquay.

*Aspidiotus ostraeformis* Curt., found on the branches and stems of young poplars at Farnham. May be readily mistaken for *A. transcaspiensis*, described by MARLATT, from material " on old dried poplar bark from Transcaspian Russia ".

*Mytilaspis ficus* Sign., on young twigs of edible fig, at Wisley (Surrey).

*Parlatoria pergandei* Comst., on branches of Japanese maple, in London.

*Parlatoria proteus* Curtis, on plants of *Vanda teres*, at Wisley.

*Lecanium ciliatum* Douglas, previously recorded in Devonshire, Cheshire and Kent ; Camberley in Surrey now added.

*Lecanium persicae* Geoffroy, on leaves of *Aralia*.

*Eriopeltis festucae* Fonsc.

*Luzulaspis luzulae* Duf.

*Pseudococcus walkeri* Newst., found rather commonly in the Camberley district.

*Pseudococcus* sp. (possibly *Ps. citri*), on a window pane at Torquay.

MEANS OF PREVENTION AND CONTROL

707 - ***Prospaltella berlesei* against *Diaspis pentagona* in Piedmont in 1915** (1). — VOGLINO P. in *R. Osservatorio di Fitopatologia di Torino (Autonomo), Relazione del Direttore*, 16 pp. Turin, 1916.

In December 1913, the " Associazione serica e bacologica del Piemonte ", in concert with various agricultural organisations and by the aid of special subsidies from the Ministry of Agriculture, Industry and Commerce, entrusted the Plant Diseases " Observatory " of Turin (assisted by the Travelling Lecturers in Agriculture) with the task of controlling *Diaspis pentagona* by means either of chemical remedies, or of *Prospaltella berlesei*. The report of the Director of the " Observatory " sets out the result of this second part of the investigations in 1915. In the spring of that year the " Observatory " distributed 304 700 branches of mulberry covered with *Prospaltella* derived from Casale Monferrato, Rosta, Lucento, Cigliano, Lombriasco, Rivoli, Asti, Pianezza, Beinasco, Stupinigi, and Azeglio, these having been found the most suitable of all the centres examined for the supply of material.

The writer sets out in detail the observations made and the results secured in each of the localities, arriving at the following conclusions :

1) The mulberry, in 1915, throve almost everywhere in Piedmont, without any trace of attacks by *Diaspis*.

2) *Prospaltella* is found in Piedmont in abundance, stopping or limiting the infestation of the mulberry tree in a great many places.

3) In some centres plentifully provided with *Prospaltella* contamination was maintained in some groups of mulberries and was introduced on others. Vegetation however continued to be regular and vigorous everywhere, thanks to the immediate intervention of *Prospaltella*.

(1) See *B.* April 1915, No. 452. (*Ed.*).

4) In very wet localities, where *Diaspis* encounters conditions highly favourable to its existence and spread, the beneficial effect of *Prospaltella* was observed almost everywhere, maintaining the mulberry in an almost normal state of vigour.

5) *Diaspis* multiplied with facility on certain pruned mulberries and on these the action of *Prospaltella* was generally found less effective.

6) *Prospaltella* does not spread in such a manner as to put a stop in a short time to the attack of *Diaspis* ; in some regions, as in the province of Cuneo, it is necessary to further its dissemination by artificial means.

7) In the provinces of Turin, Cuneo, Novara and Alessandria there are at present numerous and extensive breeding centres with *Prospaltella* in process of development. These centres have already been brought by the staff of the Observatory to the notice of farmers of the region, offices, agricultural Associations, or managers of silk reeling factories, or will be brought under their notice on a following visit in due course. These centres will be able to supply farmers with material for distribution on the spot or also for despatch to a distance in accordance with the rules which will be laid down by the Observatory.

8) In order to enable *Prospaltella* to exercise its beneficial influence on the mulberries it is essential that normal pruning should be carried out every 2 to 4 years or at any rate cutting of branches on a rational system with short period of rotation.

9) A very active destroyer of the *Diaspis* was found everywhere in *Chilocorus bipustulatus*.

10) The farmer should not take alarm if, notwithstanding an abundant dissemination of *Prospaltella*, *Diaspis* reappears on an occasional mulberry tree. The *Prospaltella* is ready to oviposit on the new *Diaspis*, but where the insect has been distributed the branches must never be cut before the month of March ; these branches must be left bound together in bundles in the field or on the trees.

11) With regard to the peach and various ornamental trees attacked by *Diaspis*, even when a thorough distribution of the insect has been made careful winter cleaning of the trunks and branches must not be omitted.

708 - **The Life History and Control of the Vine-Moths *Conchylis ambiguella* and *Polychrosis botrana*: Observations made in 914, by the Plant Diseases Observatory of Turin, Italy** (1). — VOGLINO P. in *Bollettino del Ministero di Agricoltura, Industria e Commercio*, Year XIV, Vol. II, Series B, Part 1-2, pp. 21-38. Rome, 1915.

In 1914 the observations on the life history of the Vine Moths *Conchylis* and *Polychrosis* begun in the previous year were continued (2). The investigations in 1914 chiefly aimed at clearing up the life history of *Conchylis ambiguella*, while in 1913 the development of *Polychrosis botrana* had been followed up in particular. Various information was also gained

(1) See also *B.* June 1915, No. 665. (*Ed.*)
(2) » *B.* June 1914, No. 590. »

about the latter species, which is undoubtedly the more injurious to the vine-growing regions of Piedmont.

Several Stations were installed in the different vine-growing localities of Piedmont : each Station consisted of a large cage 7 ft 10 inches by 3 ft 11 ins. and 7 ft 9 ins. in height, made of wire gauze with meshes of 2 mm. sustained by massive wooden frames. Each cage surrounded one or two vines, and was provided with a maximum and minimum thermometer, a barometer and a hygrometer. Observations were also made here and there by means of small special cages covered with wire gauze The material gathered at each Station was forwarded periodically to the Observatory of Turin where it was studied.

From the investigations, which are described in detail, the following conclusions have been drawn :

1) In 1914 infestation by the vine-moths was very limited almost everywhere as regards the spring generation, but was slightly more pronounced in the case of *Conchylis* than in that of *Polychrosis* in Stations with rather low temperature, while in the wine-growing regions of Astigiano and Monferrato *Polychrosis botrana* multiplied rapidly, especially the summer generation.

Some observers noted the appearance of the 3rd generation during or after the grape harvest.

2) The life cycle of *Conchylis* and *Polychrosis* did not differ very much from that of 1913 in reference to changes of temperature and moisture, except that the hatching period of the summer moths was prolonged and for purposes of control it was found necessary to procure accurate data as to the beginning of hatching and the duration of the flying period.

3) The use of large cages is not always successful : disease chiefly due to *Botrytis* greatly reduced the larvae in the cages, and generally vegetation was tardy and irregular.

4) The small cages suspended to the vine props, in the rows, were found much more practical. This is the only means by which the vine-grower can be accustomed to keep a watch for the appearance of the moths and their maximum flight in his vineyard, in order to apply treatment.

5) In addition to a few species of arachnids and some fungi (chiefly *Botrytis*), the larvae and the adults of *Coccinella 7-punctata* were observed to prey effectively on the larvae of the above insects.

6) The use of a 2 % nicotine solution gave good results in some localities; nevertheless in almost all cases it produced more or less marked burns. The first treatment must be applied, if possible, before the flowers open, to avoid injurious burns of the latter.

7) Tobacco extract (2%) gave good results against the 2nd generation, preventing the passage of the larvae from one grape to the other.

8) The most effective remedy against the larvae of the 1st generation is arsenate of lead mixed with Bordeaux mixture in the proportion of % . It must not, however, be used against the larvae of the 2nd generation, because then the grapes are about to ripen and poisoning may occur. The Observatory still hesitates even to advise the use of arsenate against

the first generation owing to its poisonous properties, more particularly as a 2 % solution of tobacco extract, mixed with carbonate of soda or Bordeaux mixture gives good results when spraying is done at the proper time with powerful jet pumps.

9) The experience of two years of study proves that to obtain good results with 2 % tobacco extract, two sprayings are required (both against the 1st and the 2nd generation), one shortly after the adults begin to emerge and the second in the period of maximum flight.

If the tobacco extract has proved unsuccessful, this must generally be put down either to the fact that the sprayings were not always carried out at the right time, i. e. coinciding with the two above moments of biological development, or to faults in the apparatus.

10) The Observatory therefore gives the preference to tobacco extract. This remedy at present has two drawbacks : 1) its content of nicotine not being constant, it produces burns on the vegetable tissue ; 2) it is put on the market at too high a price. When these two drawbacks have been rectified, the farmer will have a fairly reliable means for controlling these insects.

11) When arsenate of lead is to be used against the first generation, none of the precautions taken in handling poisonous substances should be neglected. The operator must wear gloves made of good skin and cover his face with a mask with glass discs let in for the eyes.

12) It was also found in 1914 that cleaning the branches in winter, destroying the tips of the canes (used as vine props) and the stubble between the lines, greatly reduced the infestation.

The substitution of stone and ferro-concrete supports, connected by galvanised iron wires, for wooden vine props, always gave excellent results.

The pieces of rag attached at the points of bifurcation of the branches acted as very effective collectors of pupae.

709 – **Tobacco Juice for the Treatment of the Vine-Moths *Polychrosis botrana* and *Conchylis ambiguella*, in Piedmont** (1). — Topi Mario, in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Series 5, pp. 349-353. Rome, March 5, 1916.

Treatment with tobacco juice of 2 % strength was applied at a vineyard situated on a hill with an eastern aspect, at Alice Bel Colle. There were six adjoining rows in the lowest part of the vineyard where the grapes had remained very abundant in spite of serious attacks of mildew. Each row treated contains about 70 vine stocks in full bearing, their distances in the rows being 1 ft 7 ½ ins. to 3 ft 3 ins., and that between the rows 9 ft 9 ins. on the average. The varieties of vine cultivated are mixed " barbera ", " dolcetto ", " lambrusca ", " malaga " and some others.

There were two applications of tobacco extract, the first on the 21st July and the second on the 28th July 1915.

At the time of the first application, the eggs of the two lepidopter-

(1) See also *B.* June 1915, No. 665. (*Ed.*)

were present on the grapes in abundance ; in some bunches each grape bore eggs, either hatched or still to hatch. 3 or 4 were sometimes found on a single grape, and some were seen even on the grapes attacked by the mildew and already withered.

The eggs were in all stages, from those recently deposited to those in which the head of the larva could be distinguished, or which were about to hatch. In the lowest rows, moreover, hatched eggs and larvae which had entered the grapes were seen. It was here observable that the larva had not pierced the grape directly below the egg, but had travelled round it and made its entry at another point.

At the time of the second treatment the unhatched eggs were still very numerous.

On the 25th August the writer gathered the grapes injured and attacked by the two insects, which were found in the bunches of four vines, two treated, two untreated, one " dolcetto ", and the other " barbera ".

The following table contains the results of the examination :

| Variety | Grapes injured or destroyed | | Number of larvae found | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Treated vine | Untreated vine | in treated vines | | | in untreated vines. | | |
| | | | *Polychrosis* | *Conchylis* | Totals | *Polychrosis* | *Conchylis* | Totals |
| « Barbera » . . . . . | 260 | 560 | 16 | 14 | 30 | 130 | 34 | 164 |
| « Dolcetto » . . . . . | 403 | 526 | 53 | 64 | 117 | 109 | 50 | 159 |
| Total . . . | 663 | 1086 | 69 | 78 | 147 | 239 | 84 | 323 |

On examining the " dolcetto " grapes the fully developed larvae of *Polychrosis* and *Conchylis* are seen to abound. A large number had probably already penetrated the grape at the time of the first treatment. It should also be noted that the larvae of *Conchylis* are found in far greater number on the " dolcetto " than on the " barbera ", although the stocks of the latter variety stand in the same rows as the former. There is nothing as yet to show whether this is due to a preference on the part of the *Conchylis* for that stock, or whether it arises from the earliness of the " dolcetto " as compared with the " barbera ", or the precocious development of the *Conchylis* as compared with the *Polychrosis*, already repeatedly recorded. It follows that the effect of the treatment differed according as the first or second variety was in question. The applications were made in good time to the " barbera ", but should have been made earlier to the " dolcetto ". This difference in behaviour is another reason for keeping to a single variety of stock for each plot of land in new plantations. Control treatment would thus be rendered easier and more effective. If *Conchylis* pre-

dominates over *Polychrosis* in the locality, it would also be as well to apply the treatment some days earlier.

On examining the grapes of " barbera " treated with tobacco extract, it is observed that many of them are only slightly and superficially attacked. On the other hand, the percentage completely spoilt on seriously attacked is much higher in the untreated " barbera " grape. While in the treated grape only one larva is found to 8 or 10 grapes attacked, on the untreated stock the proportion is one to every 3 or 4.

The results therefore were to reduce by about 50 % the number of grapes completely or partially spoilt (the fact of lesser injury to the grapes should be taken into account) and the reduction by this same figure found in the number of larvae. These results obtained with two summer treatments only should promise well for more effective control of the two lepidoptera by winter working and spring and summer treatment.

710 - **Method of Cockchafer Control used in Germany.** — ESCHERICH K. in *Zeitschrift für angewandte Entomologie*, Vol. 3, No. 1, pp. 134-156. Berlin, March 1916.

An account is given of the extensive experiments for the control of the cockchafer (*Melolontha vulgaris* and *M. hippocastani*) carried out in the " Bienwald " in the Upper Palatinate. This State forest, which covers an area of several thousand acres, has for many years been invaded by multitudes of cockchafers, sometimes occasioning widespread damage. It is made up of conifers (*Pinus*, larch and Weymouth pine) and deciduous trees (beech and oak). The comparatively dry, sandy and stony soil, forming dunes, is favourable to the multiplication of the cockchafer, the development of which has also been fostered by the very mild winter climate and, up till a few years ago, also by bad methods of forestry.

Cockchafer control was taken in hand as far back as 1882, but without satisfactory results.

Seventeen years experience of control (1882-1899) have made it clear that the action of birds and mammals preying on the cockchafer was wholly insignificant. On the other hand, the physical conditions of the forest are unfavourable to the propagation of *Botrytis tenella*, the artificial distribution of which has even been attempted. Recourse has also been had to collecting the larvae, capturing them in holes and plant traps, and destruction of the larvae in the ground, either by benzine and carbon bisulphide or by allowing pigs to grub, but all these methods have proved inadequate.

The present forester, Herr PUSTER, who took up his duties in 1899, proposed to destroy the cockchafers direct, by a new process based on the fact that at the time of flight and mating cockchafers exhibit a marked preference for certain trees growing in the open field and allowing of easy flight around and in their tops. These trees, in inverse order of importance are : the oak, the birch, the hornbeam, larch and beech.

In the course of felling work, isolated trees or groups of trees with good sun exposure and with plentiful foliage are left standing in order to attract the cockchafers at the time mentioned. These trees are called " Saug-

bäume " (" attraction trees "). They are of small size but provided with a well-developed top, the groups being called " attraction groups ".

Where the forest consists of conifers and deciduous trees, the formation of such groups or isolated trees presents no difficulty. It is very difficult, on the other hand, in forests composed of deciduous trees exclusively. In that case partial success is all that can be hoped for.

The forest is divided into sections of 741-988 acres. The capture of the insect in the different sections is entrusted to " capture gangs " of 7 persons each. One of them is the ganger responsible for the results of the work, another shakes the tree, a third carries the cloth and receptacles for capture, and the 4 others, mostly girls, stretch out the cloth beneath the tree shaken.

The cockchafers falling on to the cloth are placed in a large receptacle in which they are killed by carbon bisulphide (0.16 oz of $CS_2$ per gallon of cockchafers). They are afterwards used to make manure.

The number of gangs per section varies according to the quantity of cockchafers. In 1903 Puster used 15 to clear 741 acres of forest, in 1907, 30 for 4128 acres in 1911, 52 for 4330 acres and in 1915, 42 for 4 330 acres.

The success of the work depends chiefly on the ganger. The latter must determine the time when the control operations are to be begun ; he selects his workpeople himself and sees that the work is properly done. At the time of flight he must, especially in the evening, go over his section every day to ascertain where the cockchafers have settled and make the necessary arrangements for their capture the following morning. The insects are gathered at least once a day.

As regards the number of cockchafers destroyed by this method, the writer gives the following figures :

| | 1903 | 1907 | 1911 | 1915 |
|---|---|---|---|---|
| Area treated in acres | 121 | 4128 | 4330 | 4330 |
| Cockchafers captured in millions | $7\,^1/_2$ | 15 | 22 | 14 |

The increase in the cockchafers captured up to 1911 is due chiefly to the increased area and improved technique of control.

Assuming that among the 22 million insects destroyed in 1911 there were 10 million females capable of laying 50 eggs each (which is much below the average), 500 million larvae were destroyed with them. Considering, furthermore, that the larvae eat for four years, and that one of them may easily destroy several young trees, it is evident that thanks to the method above described, though it may not have been possible to rid the forest of cockchafers entirely, very valuable economic results were nevertheless secured, as it became possible to work the forest on the right lines.

Herr PUSTER at the same time tried to prevent oviposition in the nurseries, where the larvae of the cockchafer work immense havoc. He ascertained that 2 larvae per 11 sq. ft (in their third year of development) are sufficient to destroy all the young plants of a nursery. Collecting the cockchafers in the woods around the nurseries is not sufficiently effective. On

the other hand, when no rain falls during the period of flight of the insect, excellent results are obtained by covering the soil with quicklime (16 cwt per acre). When it rains, the females pass through the layer of lime and make their way into the ground to oviposit. If the lime is spread immediately after rain, it becomes ineffective. Evidently, therefore, the success of the method depends first and foremost on the weather.

Trial is now being made of naphthaline, the effect of which is apparently independent of the weather for its success.

The expenses entailed by cockchafer control in the "Bienwald" forest are relatively inconsiderable. They were, in 1903, 4.62 d., in 1907 5s. 7d., in 1911 4s. 7d., and in 1915 4s. per acre approximately. The chief items of expense are the collection and carting away of the insects, the cost of purchasing implements being very small. In consequence of these control measures the value of the forest has increased nearly £4000 per annum.

711 **Destruction of the Tobacco Beetle (*Lasioderma serricorne*)** (1). — Mackie D. B. in *The Tropical Agriculturist*, Vol. XLVI, No. 3, pp. 170-171. Peradeniya, Ceylon, March 1916.

The methods now used for the destruction of the tobacco beetle do not meet with great favour for several reasons; a process of treating the finished product in a purely mechanical way without disinfectant is therefore greatly desired. In order to develop a method of this kind, the effects of cold and heat were studied, but as they yielded no practical results, attention was given to a vacuum method.

For the purpose of experiment, a small metal chamber was constructed having a cubic content of 4 ½ cubic feet, fitted with a vacuometer, the pump being operated by a small electric motor developing $^1/_5$ HP. In the first experiment tobacco beetles in all stages were placed in test tubes, which were put in the vacuum chamber, and the air exhausted to a point where the vacuometer registered 27 ¼ inches. With the atmospheric pressure removed, the cellular tissue of the insects expanded, causing them to become greatly distended and producing a corresponding reduction in their vitality. However, despite the fact that the insects were held subject to these atmospheric conditions for periods up to and including three hours, many of them still showed signs of life, and immediately became active on the restoration of normal atmospheric conditions. In a second experiment insects were subjected to 27 ¼ inches vacuum, after which carbon bisulphide gas was introduced into the chamber and the vacuum reduced to about 16 inches. This treatment apparently killed all the insects. In a third experiment, more or less a continuation of the second, the gas was in turn removed from the chamber by pumps and ordinary atmospheric conditions restored. It was found that the cigars retained no odour or trace of the carbon bisulphide. In a last experiment to determine whether or not the cigars are mechanically or chemically affected by the combina-

(1) See *B.* November 1914, No. 1081. (*Ed.*).

tion of the vacuum and gas, it was found that after a long exposure the gas in question tarnished all gold lettering on the bands and labels, but that the time required effectually to destroy the insect life in the cigars was considerably less than that required to affect the colouring of the labels.

The method contribed by the Author presents the following advantages over those now in vogue :

1) The treatment in no way interferes with or delays the regular routine work of packing or handling the cigars and other products ; 2) it reduces the period necessary to kill the beetles to about $^1/_{25}$ of that necessary under the old method, the results being at the same time much more thorough than on the old method ; 3) manufacturers can treat a practically unlimited quantity of cigars daily ; 4) the cigars being treated in their ultimate containers, are not exposed to further infestation from the pest, thus obviating the necessity for specially constructed store-rooms ; 5) the noxious gases generated during the treatment are entirely disposed of by the pumps.

Alongside these manifold advantages the method has the disadvantage that it requires double fumigation to absolutely guarantee the product to be free from the pest in all forms.

712 - ***Calacoris angustatus*, a Capsid injurious to Sorgho and other *Gramineae* in India.** — BALLARD E., in *Agricultural Research Institute, Pusa. Bulletin* No. 58, 6 pp., 1 Pl. coloured, Calcutta, 1916.

INSECTS INJURIOUS TO VARIOUS CROPS

*Calocoris angustatus* Leth. (fam. *Capsidae*) is common throughout Southern India and constitutes one of the worst pests of " cholam " (*Andropogon Sorghum*). Other Gramineae are also attacked such as Cumba (*Pennisetum typhoideum*), Thenai (*Setaria italica*), Maize (*Zea mays*) and Abyssynian Grass (*Eragrostis abyssinica*), but only to a smaller extent. The adults appear as soon as the young ear heads begin to show, and oviposit under the glumes or in the centre of the floret. By the time the ear heads are free, they contain numbers of young nymphs of the orange red colour characteristic of the first immature stages. The most damage is done when the grains are in the " milk " stage, the sucking of the numerous nymphs causing the grain to shrivel and often the whole ear head to become dry and blackened.

Eggs are only laid in young and immature grains, fertilised grains never being chosen. Each female lays from 150 to 200 eggs, depositing from 1 to 16 in each flower. The eggs, which are usually laid at night, hatch out in from 5 to 7 days. The nymphs moult five times, the first moult occurring 3 days after hatching, and the rest usually every two days. The transition from eggs to adult requires between 15 and 17 days. It is possible that there are two generations on one crop of cholam, as all the ears do not ripen at the same time.

Attempts to control the pest by means of natural enemies have been unsuccessful, though the adults, when kept under laboratory conditions died from a bacterial disease.

It is suggested that the bugs contracted the disease from the ear heads

on which they fed. Experiments on the bacterial disease were not carried out in detail, though in breeding cages it proved highly contagious. The nymphs were never affected and the disease seemed confined to the adults.

Similarly, artificial methods of control (spraying ; shaking the ear heads over water covered with a film of kerosene ; immersing the heads in Kerosine emulsion, traps with lights, were either inadvisable or impracticable. It is probable that the desired remedy will be obtained by some purely agricultural method or by taking advantage of some tropism. A simple and efficacious remedy is still to be found.

713 - ***Agrotis segetum*, Beet and Potato Pest in Germany.** — LÜSTNER in *Amtsblatt der Landwirtschaftskammer für den Regierungsbezirk Wiesbaden und Zeitschrift des Vereins nassauischer Land- und Forstwirte*, 97th Year, No. 37, pp. 277-279. Wiesbaden, 1915.

The caterpillar of *Agrotis segetum* occasioned widespread ravage in beet and potato fields in Germany during 1915.

The young beets were often gnawed away to such an extent that hardly anything of the root remained.

The potatoes were also gnawed, and where the fields were heavily infested it became impossible to use the tubers for human food.

The writer thinks this invasion to be an abnormal phenomenon, related possibly to the long period of drought during the spring and summer of 1915. The drought having destroyed a large amount of their ordinary food, the caterpillars were compelled to attack the beets and potatoes. Probability is lent to this view by the fact that the constitution of the roots and tubers is such as to provide the caterpillars at the same time with a water supply. In one locality the caterpillars disappeared completely from the potato fields after a fall of rain.

714 - **Nature of the Damage caused by the "Pink Boll-worm" (*Gelechia gossypiella*) to the Cotton Shrub in Egypt.** — GOUGH LEWIS, in *Ministère de l'Agriculture, Egypte, Service technique et scientifique, Section d'Entomologie*, Bulletin No. 2, pp. 1-8. Cairo, 1916.

A study of the nature of the damage caused by *Gelechia gossypiella* Saund. to the bolls of three varieties of cotton : " Affi-Assili ", " Nubari " and " Sakellarides ". Second-crop material was used for study. For each test 100 healthy bolls were chosen and compared with 100 infested bolls taken from the same plantation.

The results obtained may be summed up as follows :

1) The percentage of fibre is reduced in the bolls attacked by the microlepidopteron.

2) In almost all cases there is a very considerable diminution in the number of seeds developing in an infected boll as compared with a healthy one. The reason may be the complete destruction by the insect of a number of seeds while still very small.

3) In the infested bolls, furthermore, a diminution in weight of the healthy seeds individually is found, which may in extreme cases amount to 26 %.

4) In these seeds reduced vitality is also observable. Their germination capacity may drop to one half of that of the seeds of healthy bolls.

5) The quantity of fibre and seed in the infested bolls is never equal to that of the healthy ones. In the worst case examined it was only one fourth, and not more than three fourths in the most favourable case, as compared with that of the control specimen.

715 - ***Zelleria oleastrella* and *Glyphodes Unionalis*, Lepidopterous Pests of the Olive Tree in Apulia, Italy.** — MARTELLI GIOVANNI in *Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore di Agricoltura in Portici*, Vol. X, pp. 89-102. Portici, March 2, 1916.

During the spring and summer of 1915 the writer was instructed to undertake control tests against *Prays oleellus* F. ("tunnelling caterpillar" of the olive tree) and *Rhynchites ruber* Fairm. at Novoli (Lecce). He was also to study insect pests of the olive tree which he might encounter in this region. He was thus enabled to observe the habits of two lepidoptera infesting the olive tree, namely *Zelleria oleastrella* Mill. and *Glyphodes unionalis* Hb., with which he deals in this article.

1) *Z. oleastrella* Mill. — The adult makes its appearance in March and April, fluttering at twilight round the leaves of the new bushy shoots at a height rarely exceeding 2 metres. Mating takes place after sunset, and the female next oviposits on the upper or underside of the more or less leathery leaves (never the very soft leaves), or along the green offsets of the shoots which have developed during the season. The egg hatches a few days after laying, and the young larva makes its way towards the leaf-stalk if born on the leaf, or climbs up quickly to the end of the shoot to take up its quarters in the soft terminal leaves whether detached from the growing point or not. Here it penetrates to the growing point itself, gnawing and devouring it inside, or else it remains on the upper surface of a young leaf, weaving a few sparse threads around it. At times, without leaving the coriaceous leaf on which it was born, or else making its way, especially in winter, to the small leaves at the end of a twig, the larva cuts a small hole in the upper face of the leaf and penetrates under the cuticle, where it digs a tunnel of variable length and irregular shape, and feeds on the mesophyll.

When more fully grown, it discontinues tunnelling, and directly devours all the green parts of the plant, piercing the leaves and the leaders.

It passes into the pupal stage in a cocoon made of very strong threads and emerges in the perfect state after a period of from 12 to 20 days.

It follows from what has been said above with regard to the feeding of the larva that it may become injurious when it attacks the new shoots of topped olive trees, young plants permanently transplanted and nursery plants. In the latter case in particular the insect is especially injurious, not only destroying the leaves, but also detaching the growing point of the leader, compelling the latter to put out new side twigs, which gives the plant an abnormal form.

As a means of larva control, arsenate of lead in paste with 1 % of water is advised. Spraying is carried out in March and April with the or-

dinary mildew sprayer, the jet of which furnishes exceedingly minute droplets. The first spraying may be followed by another ten days later.

Among the natural enemies of *Zelleria*, the writer mentions a dipteron, *Phytomyptera nitidiventris unicolor* Rond. and some hymenopterous parasites of the larva, belonging to the families *Braconidae*, *Ichneumonidae* and *Encyrtidae : Apanteles* sp., *Angitia* sp., and *Ageniaspis fuscicollis* var.

2) *G. unionalis* Hb. — The adults make their appearance in March and April. Mating takes place at night, and the fertilised females lay their eggs one by one on one of the faces of the olive leaf, or even on the green twigs of the tree. The larvae on hatching provide themselves with a shelter by means of a thin tissue of silken threads, forming with the leaf a sort of wide channel or tube open at both ends.

Some hours after construction of this shelter the larva begins to feed gnawing and devouring the leaf parenchyma and the tissue beneath it, it thus reaches the epidermis of the opposite side, but without breaking into it.

Becoming stronger, the larva gnaws away the entire leaf including the softest part of the midrib, and sometimes also the twig stem. Hence, in case of serious infestation, small twigs are found with their end broken away and residues of leaves, i. e. leaf-stalks and pieces of midrib with fragments of the base of the leaf.

The same means of control are advised as for *Zelleria*, namely spraying with arsenate of lead as a paste containing 1 % of water.

Among the natural enemies of *Glyphodes* there is included one of the Braconidae of the genus *Apanteles*, which is not yet clearly determined, and a Dipteron, *Nemorilla notabilis* Meig., preying on the larva.

716 - **The Catalpa Sphinx (*Ceratomia catalpae*), a Lepidopteron infesting *Catalpa Catalpa* and *C. speciosa*, in the United States.** — HOWARD L. O. and CHITTENDEN F. H. in *United States Department of Agriculture, Farmer's Bulletin* 705, 9 pp., 5 fig. Washington, D. C., February 16, 1916.

The common or eastern catalpa (*Catalpa Catalpa*) and the hardy or western catalpa (*C. speciosa*) are comparatively free from insect attack in the United States. Such common shade tree pests as the bag worm (*Thyridopteryx ephemeraeformis* Haw.) (1) and fall webworm (*Hyphantria cunea* Dru.) feed on the leaves, but apparently do so only in the absence of more palatable food. One insect, however, the larva of *Ceratomia catalpae* Bdv., feeds normally and exclusively on the foliage of these trees, and in some seasons does very considerable injury, often completely stripping the leaves from individual trees, and sometimes an entire grove.

Owing doubtless to the increased planting of these trees outside the region where they are found in the wild state, this insect has extended its natural range, and its injuy is more widespread than formerly. It is strictly a North-American species, common in Virginia, Maryland and Ohio ; in 1888 its range was from Virginia to Florida, westward to the Mississippi

(1) See *B.* April 1916, No. 485. (*Ed.*)

and as far north as Indiana ; of late years it has extended its range northward on the Atlantic coast as far as Pennsylvania, and westward to Oklahoma and the Missouri.

The insect appears suddenly in a locality in large numbers and then disappears for years. Its eggs are laid in masses of about a thousand ; the young larvae feeding in groups for some time. The larvae moult four times. In the extreme south the insect is found in all stages during the summer and there are three or four generations a year. Each generation lives about 6 weeks (in Florida) ; around Washington there are two generations annually.

A number of parasitic insects attack and kill *Ceratomia catalpae*. Among them *Apanteles congregatus* Say is very common and widespread through the eastern States ; unfortunately it is in turn attacked by two parasites (*Mesochorus aprilinus* Ashm. and *Hemiteles mesochoridis* Riley MS.) but they are not so abundant as to prevent the beneficial parasite flourishing. (*Apanteles*) *Microplitis catalpae* Riley, which appears to be especially a parasite of the genus *Ceratomia*, also attacks this species. It is in turn attacked by parasites : *Hypopteromalus tabacum* Fitch and (*Holcopelte*) *Horismerus microgastri* Ashm. Finally the larvae of *C. catalpae* are attacked by two species of tachinid flies : *Phorocera claripennis* Macq. and *Frontina frenchii* Will. A few birds, including the cuckoo, the catbird (*Galeoscoptes carolinensis*) and the Baltimore oriole (*Icterus galbula*) prey upon *C. catalpae*. There are several methods by which *C. catalpae* may be readily destroyed : gathering by hand, spraying with arsenical poisons, destruction of the pupae by spading the ground around the tree trunks in autumn, and by protecting the parasitic insects which attack it. The second is often the most practical method. *Catalpa* plants being frequently attacked by leaf spot (*Phyllosticta Catalpae*, etc.) and other similar diseases, arsenical spraying should be combined with Bordeaux mixture. The following proportions are advised : 6 lbs. blue vitriol or bluestone and 4 lbs. of fresh stone lime to 50 gallons of water (Bordeaux mixture). To this 1 lb. of Paris Green or 3 lbs. arsenate of lead are afterwards added.

717 - **The Parsnip Webworm (*Depressaria heracliana*), an Insect Enemy of the Parsnip, in Canada.** — BRITTAIN W. H. and GOODERHAM C. B. in *The Canadian Entomologist*, Vol. XLVIII, No. 2, pp. 37-41, 1 Fig. Pl. II. London, February 1916.

Since the summer of 1914, *Depressaria heracliana* Dec., which usually confines its attacks to the wild parsnip (*Heracleum lanatum* Michx) began also to damage the cultivated parsnip (*Pastinaca sativa*) in the vicinity of the Agricultural College of Truro.

The larvae of this insect bore through the sheath and penetrate to the young flower buds inside. Here they commence to feed, eating away and destroying the greater part of the buds. When the head bursts open the larva crawls down the leaves and stem. It feeds the green parts of the plant until it passes into the pupal stage within a light cocoon of silk and excrement. The adult emerges during the latter half of August and passes the winter beneath the bark of trees.

This insect has, in addition to the vicinity of Truro, been reported in

Hants and King's Counties, in New Brunswick, and outside Canada, in England, Scotland, Ireland, Germany, Sweden, Finland, France and the United States. It not only attacks the cow parsnip (*Heracleum lanatum*) and the cultivated parsnip (*Pastinaca sativa*), but also the wild carrot (*Daucus carota*), *Heracleum spondylium* and *Heracleum sibericum*.

Among natural enemies there are known in Europe : *Cryptus flagitator* Grv., *Pimpla heraclei*, *Hoplismenus dimidiatus*, *C. profligator* Grv. and *Ophion vulnerator* Grv.

Many larvae and pupae are destroyed by a bird, the hairy woodpecker (*Picus villosus*).

At Truro a number of hymenopterous parasites have been reared from this insect but are not yet determined.

The habit of the larva of passing a great amount of its life hidden amid seed-heads makes the control of this pest very difficult. Spraying with arsenate of lead or Paris green just as the larvae were hatching had little apparent effect. Dusting with Paris green or airs-laked lime gave better results. On the other hand, cutting off and burning affected seed-heads, as has been suggested, would result in the destruction of the entire crop in places where the infestation is as severe as in the Truro district.

718 – **The Cherry Leaf Beetle (*Galerucella cavicollis*) a Fruit Tree Pest, in the United States.** — HERRICK GLENN W. and MATHESON ROBERT in *Journal of Agricultural Research*, Vol. V, No. 20, pp. 943-949, Pl. LXIV-LXV. Washington, D. C., February 14, 1916.

The cherry leaf beetle (*Galerucella cavicollis* Lec.), reported by Davis as destroying the foliage of cultivated cherries at Bellaire, Mich., during the summer of 1894, has gradually spread and attacked other fruit trees (peach and *Prunus* spp.). During the summer of 1915, the outbreaks and the damage caused by these insects, which defoliated their hosts, assumed alarming proportions, particularly in the State of New York.

In June and July the pest was reported from the following places: Sonyea (cherry and peach) ; Collins, Gowanda, Wyoming, Jamestown,

In June and July the pest was reported from the following places: Sonyea (cherry and peach); Collins, Gowanda, Wyoming, Jamestown, Chautauqua County, Elmira, Ithaca (cherry and peach) ; Kennedy, Fredonia, Ripley (plum and peach); Perry, Scio, Olean, Honeoye Falls, Bath Holland, Perrysburg, Castile and Hornell (cherry).

So widespread an outbreak of this insect is probably due to the favourable weather conditions, which allowed of hibernation with little loss of life. The larvae of the beetle live on the native host, the *Prunus pennsylvanica* ("pin cherry"), not attacking cultivated fruit trees, and when artificially transferred to the latter they die off in large numbers.

As a means of control lead arsenate (paste) at the rate of 4 to 5 lbs. to 100 gallons of water is recommended ; good results have also been obtained with nicotine.

719 - **Morphology and Biology of the Green Apple Aphis (*Aphis pomi*), in the United States.** — BAKER A. C. and TURNER W. J. in *Journal of Agricultural Research*, Vol. V, No. 21, pp. 955-993. Figs. 1-4. Pl. LXVII-LXXV. Washington, D. C., February 21, 1916.

Owing to the abundance of the green apple aphis (*Aphis pomi* De Geer) at all times, in most apple-growing regions, and the serious outbreaks of the species, experiments were begun at the deciduous fruit insect laboratory at Vienna, Va. in 1914-15, in order to study the embryology of the insect, to explain the high mortality of the eggs in certain cases, their wintering condition, and the most suitable time to attempt their destruction.

The stem mothers feed only on the exposed green of bursting buds and tiny leaflets ; later generations preferred the leaf petioles, and then the young newly formed twigs. They avoid the leaves themselves, above all when excessively tiny. Later, when the twigs commence to harden, the aphids migrated back to the underside of the leaves, where they are found in fairly large colonies.

This selection of food occurred only when the numbers were comparatively small. In case of excessive infestation, twigs, leaf petioles and the underside of the leaves are attacked simultaneously.

One of the most striking symptoms of the attack is the curling of the leaf in the spring and the first half of summer. Contrary to supposition the aphid never attacked the apple fruit during these experiments.

When furnished with a tender, succulent food during larval life, the adults are large, plump and light green in colour. On the other hand, if the food is poor in quality, the adults will be smaller, dark green, and the bodies will be much wrinkled. The insect will also require a considerably longer period to attain maturity.

The eggs laid in the autumn on the tender twigs of the apple develop rapidly for a few days, after which they rest for the winter. When the formation of the embryo is completed in the spring an increase in temperature will cause the eggs to hatch. Before this, a high temperature only tends to destroy it.

The stem mother is wingless, and produces summer forms both winged and wingless, the former predominating. Mating commences towards the close of September, and the fecundated eggs are laid at the ends of twigs as stated.

*A. pomi* was first mentioned by De Geer in 1746, in Sweden, and has been successively reported and described by various writers in all parts of Europe, Turkestan (Asia), and the Orange River Colony (Africa).

It certainly made its appearance in the United States as far back as 1883, in the State of Washington and the district of Columbia. It was reported in 1894 at St. Louis, and in 1897 in Illinois. It is now common where ever the apple tree is cultivated.

In Canada it abounds in all provinces from Nova Scotia to British Columbia.

In America, just as in Europe, really serious and injurious outbreaks occur at various intervals. In 1911, Virginia sustained heavy damage.

*Effect of Food on Rapidity of Development and Reproduction of Aphis pomi.*

| Poor food, insects small | | | | Good food, insects large | | | |
|---|---|---|---|---|---|---|---|
| Experiment No. | Date born | Pupal period | Number of young produced | Experiment No. | Date born | Pupal period | Number of young produced |
| 1 559 | Aug. 5th | 10 Days | 15 | 1 617 | Aug. 13th | 7 Days | — |
| 1 643 | Aug. 14th | 10-12 » | 8 | 1 687 | Aug. 19th | 7–8 » | 28 |
| 1 645 | do. | 10–12 » | 14 | 1 839 | Sept. 1st | 7–8 » | 20 |
| 1 488 | July 28th | 11-13 » | 44 | 1 754 | Aug. 21st | 7–8 » | 25 |
| 1 660 | Aug. 17th | 12 + » | — | 1 807 | Aug. 27th | 7–8 » | 25 |
| 1 852 | Sept. 10th | 12–14 » | — | 1 856 | Sept. 2nd | 8–9 » | 23 |
| Average . . . | — | 11.5 | 10.25 | — | — | 7.7 | 24.2 |

In 1912 the States of New England and New York were ravaged by the insect. There are, however, some parts where the insect is constantly present and injures the crops every year, such as Colorado, for instance, where it is rightly regarded as one of the worst orchard pests.

Appended is a list of 19 publications.

720 – ***Platypus wilsoni*, a New Species of Coleopteron Attacking Coniferous Trees in British Columbia.** – SWAINE J. M. in *The Canadian Entomologist*, Vol. XLVIII, No. 3, pp. 97-100 with plates VI-VII. London, March 1916.

This insect is very abundant and injurious on the southern half of the coast of British Columbia. The adults excavate a cylindrical tunnel from about 6 to 14 inches in length through the bark and directly into the wood of large and small trunks, in small trunks usually curving around the heart-wood. A characteristic fungus always found coating the walls, and causing black stains, serves as food for the larvae, and to a lesser degree for the adults. Eggs, larvae and adults are found free in the tunnels. It attacks all conifers of the British Columbia Coast, with the exception of *Thuya* and *Chamaecyparis*, but is most abundant in *Pseudotsuga*, *Tsuga*, and *Abies grandis*. Dying or badly weakened trees and freshly cut logs are usually selected for attack, but standing trees with abundant green foliage are not infrequently affected. Frequently, this insect pest attacks the trees injured by ground fire. A tree attacked by *Platypus wilsoni* and by *Gnathothrichus* is invariably beyond hope of recovery.

ALFREDO RUGGERI, *gerente responsabile*.

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

# INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (*Ed.*).

FIRST PART.

# ORIGINAL ARTICLES

## The Present State of Agriculture in Sweden

by

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Since the remotest times, Sweden has been practically entirely an agricultural country. Half a century ago agriculture was still almost the only industry of the country, and production was sufficient for the needs of the population.

Since then the importance of agriculture has undergone a continuous decline. The proportion of persons directly deriving their livelihood from it has not kept pace with the increase in the population, or with the growth in the cultivated area. In 1870, rough calculations showed the agricultural population to form 71.9 % of the total, with 476 persons per 1000 acres of cultivated land, but in 1910 the corresponding figures were 48.2 % and 292 persons. Notwithstanding this, up till 1890 the agricultural population showed an increase in absolute numbers; after that date it fell from 2 915 000 to 2 663 000.

During the same period agricultural production became more and more inadequate to supply home consumption. In the period 1871-1880 the value of exported agricultural produce was on the average equal to that of imports (imports 52 932 000 kroner ; exports 55 497 000 kr.) (1) ; between 1901 and 1910 the average for all imports was nearly double that of exports (110 409 000 against 55 474 000 kroner), and from that time till 1914 the discrepancy has continued to grow.

These facts, however, prove neither absolute stagnation nor decline of agriculture, its production having grown in greater proportion than the number of the population, namely 4 times as against 2.5 times in the course

(1) 1 Swedish *krone* = 1 *s.* 1 $^{1}/_{5}$ *d.*

of a century. The average value of a crop of the country has about doubled since 1880, with an increase of 50 per cent. since 1900. The consumption per head, however, has shown a still greater increase, rising in one century from 515.88 to 992.08 lbs of cereals and from 194 to 399 lbs of bread-stuffs (rye and wheat) per person.

The relative retrogression indicated by these facts is chiefly due to the rapid development of industry, which absorbed a constantly growing proportion of the rural population, leading to what is termed " the desertion of the countryside ". The value of industrial products rose from 1000 million kroner in 1909 to 1772 million in 1912, while the crop value in the same period only went up from 600 to 900 million kroner.

To remedy this state of things various measures have been adopted for the promotion of agriculture. One of these was the reorganisation of the *agricultural administration*. In 1882 the administration of State forests and domains was placed in the hands of a new institution, the *Direction of Domains*, and 7 years later the *Department of Agriculture* was established as a central office for agricultural matters, which had till that time been dealt with by the executive Committee of the Royal Academy of Agriculture. In 1900 agricultural affairs were transferred from the Home Office to the newly created Ministry of Agriculture. Since 1889 the Academy of Agriculture, in its capacity as a scientific society has confined its work to the study of scientific questions in connection with agricultural experiments.

In the provinces, the chief intermediaries between the Government and farmers in all matters involving the welfare and progress of agriculture are the *Societies of Rural Economy*. Their duty is to work in their respective districts for the development of agriculture and allied industries, by education, by example, and by distributing rewards. They organise competitions, compile figures to form a basis of agricultural statistics, etc. They possess considerable resources, amounting in 1913 to about 4 million kroner (investments 400 000, members' subscriptions 50 000, public subscriptions 2 434 000, special appropriations 775 000 kroner).

The growing concern of the public authorities for the development of agriculture is also evident from the considerable increase of State expenditure for this object of late years. Such expenditure amounted in 1901 to 6.1 million kroner or 3.3 per cent. of the total estimates ; in 1915 it attained 14.1 million kroner, or 5.2 per cent.

Agricultural wealth is continuously increasing, though more slowly than the total wealth of the nation. According to the official taxation assessment, the following were, in 1900 and 1914, the values of real estate in millions of kroner :

| | 1900 | 1914 |
|---|---|---|
| Agricultural estate . . . . . | 2 355 = 52 % | 3 762 = 38 % |
| Other estate . . . . . | 2 147 = 48 % | 6 021 = 62 % |
| Totals . . . . . | 4 502 = 100 | 9 783 = 100 |

A special calculation made in 1908 gave the following values (in millions of kroner) for real and personal agricultural property.

| | | |
|---|---|---|
| Real estate | 3 679 = 26.6 % | of the national wealth |
| Livestock | 660 = 4.8 % | " " " |
| Implements etc. | 322 = 2.4 % | " " " |
| Total | 4 661 = 33.8 % | of the national wealth |

Needless to say, in a country as extensive and varied in character as Sweden, the ratio between the values of the different descriptions of property changes very much. Neglecting extreme cases, these values on normal farms may be estimated as follows per acre of land cultivated :

| | | |
|---|---|---|
| Land capital | 160 — 800 | kroner |
| Livestock | 80 — 240 | " |
| Implements, machinery, etc. | 40 — 200 | " |
| Working capital | 80 — 160 | " |
| Total | 360 — 1 400 | kroner |

*Agricultural Credit.* — The real estate is generally encumbered with a considerable mortgage debt. For all the real estate together it amounted in 1912 to 51.7 per cent of the taxable value, but the share of agricultural property in this figure is not known.

Agricultural land credit is provided by 10 *District Mortgage Associations*, organised on the pattern of the German " Landschaften ". The loans are granted by the *General Mortgage Bank* of which the said associations are the sole members. This bank operates under the control of the State, which provided it with a guarantee fund of 30 million kroner in State stock. The outstanding loans by the provincial associations amounted in 1913 to 291 million kroner, or 7.7 per cent of the value of the mortgaged property. These societies are resorted to chiefly by large real estate owners ; small owners generally apply for the necessary advances to ordinary banks, public loan funds and private persons.

The provision of financial facilities for working capital has just been organised by a law of 1915 through the agency of *Local Agricultural Co-operative Societies* and Central Societies, but none of these institutions has yet begun to operate.

*Association and co-operation*, which at present play so important a part in the advancement of agriculture in most countries, did not gain a footing in Sweden until a late date. Latterly, however, they have made great headway concurrently with the growth of interest in the small farmer. The first co-operative dairies sprang up between 1860 and 1870, and, after various changes in organisation, multiplied until they numbered about 600, or 40 per cent of all the dairies of the country.

Later on, about 1885, farmers began to form associations for the joint purchase of fertilisers, concentrates and other primary necessities, and, in 1905, this co-operative movement resulted in the creation of the *National*

*Union of Provincial Societies and Local Associations.* The latter, now exceeding 1,000 in number, receive orders, effect the distribution of the goods purchased and collect payment. The provincial societies, at present numbering 22, receive orders and conclude transactions either direct with manufacturers and traders, or, in most cases, through the agency of the National Union, whose turnover in 1915 amounted to 24.5 million kroner.

The fundamental principle of this co-operation is the supply of goods at the market price of the day and the distribution of the profits among the participants rateably to the purchases of each. Associations or unions were afterwards formed to provide for almost all the needs of farmers in almost all branches of their work. These associations placed all the technical facilities of modern agriculture at the disposal of all growers, particularly small farmers, and assisted them to market their products to advantage, at the same time instructing them, by competent advice in all matters concerning agriculture and stock rearing. It is this latter point which lends importance to these associations in quite as great a degree as the economic advantages which they directly provide for their members.

The principle gaining ground more and more in these associations is that each member has one vote only, while participation in the profits and expenditure is in proportion to the shares held by each member or the area of his cultivated land, the number of his cows or the amount of his purchases or deliveries.

The present status of agricultural associations is shown by Table I containing statistics in reference to the different classes of economic societies in connection with Swedish agriculture.

TABLE I. — *Swedish Farmers' Economic Societies.*

| | |
|---|---|
| Mortgage Credit Societies | 10 |
| Purchasers' Societies: | |
| National Union | 1 |
| Provincial Societies | 22 |
| Local Associations | 1 100 |
| Societies for the production of peat litter | 30 |
| Stock rearing Societies: | |
| Stud Societies (Horses) | 160 |
| " " (Bulls) | 1 600 |
| " " (Pigs) | 600 |
| Inspection Societies (for cowsheds, piggeries, etc.) | 750 |
| Poultry-keeping Societies and Egg Sales Unions | — |
| Cooperative Dairy Societies | 700 |
| Societies for exportation of Butter | 2 |
| Co-operative Butchers | — |
| Societies for the Sale of Seeds | — |
| Societies for the Sale of Market-garden produce | 4 |
| Societies of Fruit-growers | 420 |
| Fisheries Societies | — |

*Labour* (1). — The relative decline of the agricultural population has exerted a perceptible influence not as regards the number of farmers (landowners and tenant farmers), but only as regards the number of labourers. It imposed greater economy of labour, but gave rise to no real difficulty in finding the necessary labourers for agricultural work and care of livestock, except in 2 cases :

1) For the extensive sugar beet cultivatons in the south of the country, emigrant labour had to be engaged, coming chiefly from Galicia and Poland, to the number of 1 000 to 1 300 persons of both sexes.

2) There is a permanent difficulty in finding farm hands, male and female, to look after the livestock and milk the cows.

The shortage of labour has also led to a considerable rise in wages, which have increased threefold since 1870, the present yearly wage for a man being 320 kroner, and for a woman 180 kroner ; the day wage in summer (without board or lodging) is 2.5 kroner for a man and 1.5 kroner for a woman ; these figures are the averages for the entire country.

Wages are generally the largest item of farm expenditure, and therefore their rise, which far exceeds that of the selling price of agricultural produce, has been a powerful factor in weakening the economic position of agriculture.

Hired labour formerly consisted chiefly of farm hands, male and female, hired by the year against fixed salary and board and lodging in the farmer's house ; on rather larger farms, again, a considerable part of the work was carried out by peasants who were under certain obligations of labour or payment, and by persons (" Torpare ", " Köthner ") to whom small holdings were granted in consideration of a number of days' labour per week, with the right also of doing paid labour. Great changes have taken place in this respect. Farm hands of both sexes are generally quick and strong labourers, but owing to the trouble of finding them board and the difficulty of moral supervision over them, the attempt has been made to replace them by married labourers (" Statare ") receiving wages and lodging ; the latter, however, instead of being fed in the employer's kitchen, receive a given quantity of the most important commodities, for instance, about 24 cwt. of rye; 22 bushels of potatoes; 6 or 8 cwt. of wheat for feeding livestock (pigs) per year; 5 ⅓ pints of full-cream milk per day, the same quantity of skim milk; wood fuel, and a piece of land for planting potatoes.

The forced labour tribute due from certain peasants either in the form of days of work or particular kinds of work, has long since been replaced by payment of a tenancy rent in money ; among the " Torpare " who occupy the above small holdings, the tendency to pay their dues by working them off has become more and more general. This form of contract is extremely favourable, both to the landowners who obtain labourers at the cost of the rent of patches of land of little value transferred to the latter, and to the tenants who thus have their own home, while their livelihood is secure, as they are always certain to find work on the owner's farm.

(1) See *International Review of Agricultural Economics*, February, March and April 1916.

Notwithstanding these mutual advantages, however, the number of such tenants shows a tendency to decline, and the difficulty of finding new ones becomes greater and greater. Consequently, agricultural labour continues to be supplied by farm hands, male and female, engaged by the year or for six months, but in the case of large agricultural estates, chiefly by " Statare ", or married labourers, who receive wages in money and in kind and are also bound to allow their wives to assist, for an agreed payment, in milking the cows and in harvest work. In all cases, however, the endeavour is to reduce the number of labourers on fixed contract as much as possible, replacing them by day or job labourers.

THE CULTIVATED LAND AND ITS UTILISATION. The total area of land in Sweden is about 101,400,000 acres divided as follows :

TABLE II. — *Division of Land in Sweden.*

| | Area in acres | % of total area |
|---|---|---|
| Gardens | 113 671 | 0.1 |
| Arable land | 9 085 867 | 9.0 |
| Natural grass-land | 3 148 054 | 3.1 |
| Forest | 54 942 685 | 54.2 |
| Unproductive Land | 34 107 213 | 33.6 |

Nevertheless, owing to the great size of the country (extending between latitudes 55°2' and 69°4') and its geographical and geological configuration, there is a great difference in the relative proportions of the different kinds of land both between north and south and between the mountain and forest stretches of country with moraine soil in the interior and the clayey or sometimes sandy plains bordering the coasts between the Baltic and the Kattegat. The extremes are represented by the province of Scânia, where cultivated land forms as much as 60 per cent. of the total area, and that of Norrbotten, in which less than 0.4 per cent. of the land is cultivated. The area of cultivated land is continually on the increase, chiefly through the reclamation of marshes, but the proportion of increase shows a constant decline. 25 years ago the increase was usually 74 133 acres per annum, but during the last ten years it has only been 24 711 acres per year. This is a consequence of the increased cost of labour. The bulk of the reclamation work is carried out with the assistance of the Government, which in 1915 for instance appropriated 1 400 000 kroner for loans with that object, and 2 350 000 kroner for grants not subject to repayment.

Clearing work is principally carried out on the peat soils, which have gone up greatly in value for cultivation purposes since rational fertilisation was rendered possible by the use of artificial manures. The results obtained in this direction were due to a large extent to the investigations of the *Swedish Marsh Reclamation Society.*

Small farms show a continuous increase at the expense of the large ones, the number of which is constantly decreasing. The former total about 360 000, besides which there are about 140 000 small holdings, mostly al-

lotted to labourers against payment in the form of labour for the landlord. It is calculated that on about 70 per cent. of the independent farms, and on all the holdings, the area of cultivated land does not exceed 25 acres, which means that they can be worked without hired labour. Farms averaging 25 to 124 acres of cultivated land represent 28 per cent and large estates with more than 124 acres of cultivated land a little more than 2 per cent. of the total number.

The area of cultivated land is divided as follows among the different classes : one half belongs to farms of medium size ; about one fourth to small farms ; and the same to large estates.

This distribution, however, varies greatly in different parts of the country, the large estates, particularly manorial estates, lying chiefly in the fertile plains, while the small ones are in the uplands where the cultivated land is scattered among the mountains, rocky hills, marshes and streams. In the northern forest districts in particular there are hardly any but small tenant farmers, the land belonging mostly to big forest estates. Increased facilities of transit and industrial development have also to some extent affected the distribution of agricultural property, small farms being numerous in the neighbourhood of large towns, industrial centres and railway junctions.

In Sweden the land is for the most part tilled by the owners themselves, in the proportion of about 85 per cent.; the larger the acreage of farms the greater the proportion worked by tenant farmers. The position of the latter towards the landlord has been greatly improved by the new laws of 1907 and 1909 on tenant farmers. In the northern provinces especially, where a large proportion of the land belongs to commercial companies, the rights of the landlord have been restricted in favour of the tenant farmer.

*Measures for the Benefit of Small Farms.* The great increase in the number of small farms is partly due to the attempts made to stem townward migration. In order to facilitate land settlement by small farmers, the State has for some time been selling the land in small plots. All Crown domains not yielding a minimum which was fixed in 1874 at 200 and in 1892 at 600 kroner, are put up for sale when the farm leases expire. Under the decrees of 1894 and 1899, moreover, those parts of Crown domains which are suitable for forming separate farms must be split up and put up for sale or let. Between 1894 and 1912, about 1800 small farms were sold in the central and southern part of the country. In the northern provinces, portion of forest domains suitable for cultivation are allotted rent free for the first 15 years, and for a moderate fixed rent during a further 50 years. The primary object of these grants was to provide the public authorities with the necessary labour for forest maintenance, but no obligation in this respect is imposed on the settlers. The number of holdings of this kind is about 1 200.

Division into small holdings is greatly facilitated by the simplicity of legal formalities, chiefly owing to a law of 1896 which enables cultivated land to be separated from forest, the latter being more difficult to work in small plots. This law however does not apply to the northern provinces, where agriculture could hardly be self-supporting without the contribution

of the forests to the financial return. The Government has encouraged the increase of small farms by a system of financial facilities. Loans are granted up to the amount of 5/6ths of the value of the land and buildings, at 3 per cent interest with repayment over a long period. Between 1905 and 1913, about 8 900 loans were granted representing a total slightly above 25 million kroner.

For a quarter of a century the small farmer has also been provided for in other respects by the public authorities, having been the chief one to profit by the subsidies granted for the reclamation of waste land and the development of stock rearing, and also by the assistance furnished by scientific agriculturists in the service of the State or rural economy Societies.

The Government furthermore allocates every year a certain sum (now 400 000 kroner) for the encouragement of the small farmer in the following ways :

(1) Premiums for the clearing of small areas of brushland etc.

(2) Competitions between small farms with premiums and conditional loans (totalling about 50 000 kroner per year) for works of improvement ; if the work has been carried out satisfactorily within the time fixed, the repayment of the loan is postponed.

(3) Subsidies to Inspection Societies and Societies for the proper keeping of books of account on farms.

(4) Educational courses (in 1913, 264 courses at a total expenditure of 71 000 kroner) and excursions for agriculturists, male and female (in 1913, 810 persons took part), with subsidies totalling 61 000 kroner.

*Crops.* — The types of crop grown differ greatly according to climatic and soil conditions, and general farming standard. The simplest methods of cultivation are practised in the north. Grain growing is very limited there owing to the short summer ; it only extends over 10 to 30 per cent. of cultivated land, and mostly comprises spring cereals; chiefly 4-rowed barley which is the earliest, while winter wheats, which occupy the land for 2 summers, are less suitable. Fallowing is only applied before the winter wheat. Towards the south, oats gain the upper hand. Artificial grass-lands cover a wide area (averaging 60 per cent. of the cultivated area) in the northern provinces, and are left uncleared for a longer or shorter period of time (up to 20 years) in the more northerly parts.

In the central and southern portions of the country there is greater equality of distribution of the different cultivations. In proportion as the general farming level improves, fallowing and laying down to grass decreases, while on the other hand grain crops and pulse crops for green or dry forage increase ; above all there is a large increase in root crops or forage.

In those parts of the country where farming practice is on a lower plane the most usual rotations are as follows : 1) fallow ; 2) winter cereal (rye and wheat) ; 3-5) artificial grass-lands; 6-7) spring cereals (oats and barley), pulses (peas and vetches) and mixed crops. An almost equal proportion (about 40 %) of the land in this part of the country is under grain and

leys, 10 to 15 per cent. of the land being fallow, 3 to 4 per cent planted with potatoes and 0.5 to 1.5 per cent with forage root crops.

In the districts where farming practice reaches the highest level, fallowing often disappears, the soil being tilled by harrowing and ploughing in, especially after the hay and green forage crop ; the land is only sown to grass for one or two years, and to the extent of 15 to 20 per cent of the acreage cultivated. The greater part of the land is under grains and pulses, cropped when ripe or as green forage. Finally, particular attention is given to root crops, which may occupy up to 25 per cent of the arable land. As examples of the rotations practised in these districts there may be mentioned: 1) green forage (peas, vetches, oats and barley) ; 2) winter cereals (particularly wheat); 3) root crops (sugar beet and forage roots) ; 4) spring cereal ; 5) grass ; 6) spring cereal — or else 1) root crops ; 2) spring cereal ; 3) grass or green forage ; 4) winter cereal.

The distribution of the different types of cultivation varies greatly according to the quantity of soil and the climate. Winter cereals are chiefly cultivated in the plains, where they take up 15 to 20 per cent of the cultivated land, wheat only in clayey soils, and rye in sandy soils also, where, together with potatoes, it forms the most important crop. In marshy soils winter cereals do not stand the climate well. Wheat, which is more exacting than rye as regards the nature of the soil, on the other hand furnishes a greater yield under favourable conditions and its cultivation has been considerably extended of late years.

Barley and oats are only grown as spring cereals, barley, (4-rowed) chiefly in high lands with light stony soil ; oats everywhere, except in the north of the country, cover the greater part (up to 30-40 %) of the cultivated land, being chiefly planted on lean and also marshy soils. 2-rowed barley is only grown in the plains, chiefly on the best soils with a sufficient proportion of lime.

Peas and vetches are almost everywhere grown mixed with oats and barley, rarely alone ; this crop is chiefly raised on soils rich in lime. Beans are entirely limited to the lands skirting the west coast.

Potatoes are cultivated on all the farms of the country, generally in proportion to local need, so that almost everywhere the same proportion of the land is allotted to this crop (3 to 5 %). In the southern provinces alone, where the soil is sandy, the area planted with potatoes is considerably larger, the excess of the crop over local consumption being used chiefly for the manufacture of alcohol and starch. Root crops are mostly grown in the south of the country, where the sugar beet, under intensive cultivation, is of great importance from the point of view of rural economy. In Scania this crop occupies 10 per cent of the cultivated land, while in the other provinces it rarely exceeds 1.5 to 2 per cent. It receives special attention owing to its importance in crop rotation and for stock rearing.

Natural grass-lands were at one time very extensive, but have now largely been brought under cultivation, the remainder now occupying only one-third of the productive surface. Most of these grass-lands receive no cultivation or manuring whatever and their yield is consequently

rather low, probably not averaging more than 12 cwt. of hay per acre. Of late years, following German example, the grass-lands have begun to be used for grazing on rational lines, producing a considerable increase in their yield.

*Seeds.* — Grain and leguminous (pea, bean and vetch) seeds as well as seed potatoes are obtained from home crops exclusively. Until lately on the other hand, seeds of forage plants (including root crops) were mainly imported. This is of course a weak point, but it does not mean that with the majority of these plants there is any difficulty in growing good quality seeds within the country. On the contrary, Swedish seeds are held in high esteem because of the certainty of their being suited to the country, and of the guarantees obtainable as to purity.

With regard to pasture grasses, the majority of the most common species, timothy, red clover and hybrid clover are cultivated. Red clover is distinguished into the early and late varieties, the former being used for sowing leys of 1 or 2 years duration, particularly in southern Sweden, and the latter for longer periods. Both late and hybrid clover seeds are grown chiefly in the country, while those of early red clover are almost entirely imported. They are termed " Silesian clover seeds ", but they are also imported from Bohemia, Moravia, and especially Russia. French, Italian and American red clovers are wanting in powers of endurance, and are therefore not rated very high. To facilitate verifying the origin of seeds, a law of 1909 provides that red clover, hybrid clover and timothy seeds must when imported be dyed red with eosin. Seeds of pasture grasses (except timothy seeds) and for root crops are still mostly imported, but during the last few years the most common forage plants in addition to timothy such as cocksfoot, rye grass and brome grass, as well as radishes, turnips, carrots and sugar and forage beets have begun to be grown for seeds to an ever increasing extent and with perfect success.

*Seed testing.* — There are 17 establishments receiving Government grants and operating according to official regulations which are substantially the same in Scandinavian countries. This testing has been carried on for 40 years (since 1877), and as a result the quality of the seeds put on the market is generally fairly satisfactory, and adulteration is rare.

*Yields.* — The averages in Sweden (wheat, 16.72 cwt per acre, rye 12.74 barley 12.74, oats 11.94, potatoes 79.65, sugar beet 238.96, forage roots 278.78) are almost the same as the average figures for Europe. They are below those of other Germanic countries, but higher than of Slavonic and Latin countries, except Belgium. These averages, however, like the level of agriculture, vary greatly in the different parts of the country. In the best regions they approximate to the crop value of the countries leading in this respect. The constant increase of yield recorded during the last decade justifies the hope that progress will continue.

This progress in yield is largely due to the fact that the old seeds have been replaced by better grades coming mainly from the Svalöf Institute, which enjoys the highest repute even outside the country for

its work of improvement of crops (1). The varieties of oats and barley which are most grown in the country give on the average a crop 15 to 29 per cent. bigger than that of the old variety, and the latest improved wheat, though only grown to a small extent so far, shows a still higher superiority over the old varieties. Of course progress in this respect is chiefly observable in the southern and most fertile portions of Sweden, while the difficulty of increasing the yield by seed improvement increases in proportion as the summer becomes shorter, the soil poorer and the climate drier.

*Agricultural Improvements.* — The increase of yield is partly the result of land improvements and progress in cultivation work. *Drainage* is of the utmost importance in a country where the land is so hilly and broken and the soil is as retentive of moisture as clay and peat soils. This matter however, is still largely neglected, a large portion of the land being drained by open ditches only, and drainage by covered conduits and pipes making but slow progress owing to the high cost of labour. To encourage covered drainage on small farms, the Government grants loans at low interest.

Progress is more marked as regards *ploughing*, which is now done deeper, generally to at least 7 $^3/_4$ inches but often to 10 inches. Attention is also given to methodical utilisation of the soil moisture, which is of the utmost importance in a country where the rainfall during the 6 summer months usually does not exceed 13.3 inches and during each month of the spring and early summer (May and June) is only 0.78 to 1.57 inches.

In ploughing during spring and summer the principles of dry farming are generally applied, that is to say, the soil is usually consolidated so that the capillary moisture can rise from the deeper strata, and the surface layer is loosened to prevent loss of moisture by evaporation.

The striking development of the industry of *agricultural machinery* in Sweden has been a factor in more effective and scientific tillage. This industry supplies the country with machines and implements which meet farming requirements, and it has now made such strides that whereas in former years a considerable quantity of such machinery was imported, it is now exported to a value of 12 to 15 million kroner.

*Manures and Manuring.* — *Liming.* The regions where the land is made up of limestone rocks, belonging chiefly to the Silurian formation, far exceed in fertility those poor in lime and belonging mainly of archaic origin. The manures used in these regions are, to a large extent, either finely ground limestone or lime, and also, but only to a small extent nowadays, marl. In order to promote the use of these effective means of increasing fertility, the Government makes a grant towards the cost of carriage of lime for manuring purposes.

*Farmyard Manures.* — As, comparatively speaking, there is plenty of livestock, there is no shortage of *stable manure*, which has latterly been put to more effective use. Instead of manuring only once per rotation, as was done formerly, the manure is now spread over several breaks, so as to

(1) See June 1913 ; pp. 851-860, The Swedish Svalöf Institute, by N. Hjalmar Nilsson. pp. 861-870 ; Wheat and Oat selection at Svalöf, by H. Nilsson-Ehle.

render its effect more uniform and complete. Greater care is also taken to preserve the fertilising elements, especially the nitrogen, in the manure, The stable manure is usually mixed with peat litter and compost. It has become more and more usual to provide the dung pit with a concrete bottom, and , on small farms, to keep the dung heap in a special shed.

The use of *chemical fertilisers* is still very limited. On marshy soils very poor in phosphorus and potash, potassium phosphates and salts are still used, and on soils poor in humus, for grain and root crops, phosphates and Chili nitrate or cyanamide are also in general use, but the quantities are too small to produce a maximum yield. The chemical manures are chiefly imported from abroad. Superphosphate and cyanamide, however, are manufactured within the country in quantities exceeding home consumption, the crude phosphates for the former being in turn imported. Two steel works also produce phosphated slag, but the supply from this source does not suffice for even half the consumption. Attempts have been made at different times to obtain potassic manures from the abundant strata of rocks with high potash contents in the country, but without success hitherto. The quality of chemical fertilisers is tested at 9 chemical Stations which receive State grants.

SECOND PART.

# ABSTRACTS

## AGRICULTURAL INTELLIGENCE

### GENERAL INFORMATION.

721 – **Creation of a School of Silkworm Rearing in the Republic of Colombia.** — *Revista agrícola, Organo del Ministerio de Agricultura y Comercio*, Year 1, No. 11, pp. 642-644. Bogotá, November 1915.

AGRICULTURAL EEUCATION

By law No. 13 of 1915 the Government of Colombia provided for the encouragement of the silk industry which may prove a source of wealth to the country. In pursuance of this law, some trials of mulberry growing and silkworm nurseries having proved successful at Bucaramanga, there was created in that town, by decree No. 1989 of 1915, a School of silkworm rearing to which an annual appropriation of 1860 pesos (£ 387.10 s. at par) has been made, to which there will be added the proceeds of the silk produced, woven and sold by the School.

722 – **The Organization of the Cuban Agricultural Experiment Station** (Progress of Agricultural Science in Cuba). — CRAWLEY J. T. (Director of the Cuban Agricultural Experiment Station). *Modern Cuba*, Vol. 5 (8), No. 2, pp. 28-46, Havana, Feb., 1916.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

The Cuban Agricultural Experiment Station was established at Santiago de las Vegas in 1904 by the first President of the Republic of Cuba.

The Station is divided into Departments, each with its chief, assistants, and necessary laboratory and other facilities, as follows.

1) *Agriculture.* — To this Department is given the experimental work with the more important crops, such as sugar cane, tobacco, corn and the various crops used for cattle feed, and green manuring.

2) *Horticulture.* — This has charge of the growing of fruits and vegetables, and the care of the grounds.

3) *Botany.* — This Department has gathered and cares for an herbarium of Cuban plants, and has charge of the study of forest trees, their distribution and utilization, vegetable fibres, medicinal plants, etc.

4) *Chemistry.* — Analysis of soils, fertilizer and agricultural products; not only those originating in the Station but those sent from without. This Department also has certain well-defined fertility problems for investigation.

5) *Pathology and Entomology.* — This is one of the most important Departments, since it has to deal with the difficult problems of the study of insect and plant diseases and proper methods for eradicating them. The problem has been more difficult owing to the fact that the tropics offer ideal conditions for the development of plant enemies, both insect and fungoid, and since so little work of this kind has been done in the tropics.

6) *Animal diseases.* — The laboratory carrying on investigations in animal diseases, and engaged in preparing vaccines and serums, was established under the direct supervision of the office of the Secretary of Agriculture and was transferred to the Station in March 1914. While it has the study of animal diseases in general, its principal work at the present time is the preparation of vaccines used in combating anthrax, black-leg, and hog cholera.

7) *Veterinary Medicine and Animal Husbandry.* — This Department is charged with the introduction and breeding of the best breeds of domestic animals, the study of butter and cheese making, the feeding values of various Cuban-grown feeds, and also the study of animal diseases.

While each Department has its own apparatus and problems, yet there is no fine line of demarcation between them and the closest cooperation among all officers is fostered.

## CROPS AND CULTIVATION.

AGRICULTURAL METEOROLOGY

723 - **Temperature Changes due to Terrestrial Radiation and Relation of the Latter to Plant Growth.** — ROSTER GIORGIO, in *Atti della Reale Accademia dei Georgofili di Firenze*, 163rd Year, Part I, pp. 1-27. Florence, January 1916.

The altitude chosen for meteorological observatories, their inevitable northerly exposure, and the arrangements for protecting the instruments from local influences, create an artificial environment differing too much from that of plant life. Consequently the information gained hardly admits of application to such life. The proper course would be for all determinations made for purposes of agriculture (such as mean temperature of seasons, months and days, mean and absolute extremes, heat variations at short intervals causing variability of climate) to be conducted under heat, light, wind and moisture conditions as near as possible to those of plant life.

Maximum and minimum thermometers are best placed in the open air. If there is only one instrument it should be put at a height of 3 ft. 3 ins.; a second, if available, at a height of 6 ft. 6 ins. A third might very usefully be put under high timber trees at a height of 4 ft. 11 ins., in order to ascertain what amount of protection from terrestrial radiation these trees afford to plants under cover of them. In his garden of Otonella, island of Elba, Italy, the writer found that a thermometer placed under the dense

foliage of a carob tree shows minimum temperatures 3 to 4 degrees Centigrade above those of a thermometer in the open air.

In the same garden, from March to September 1913, observations were taken of the daily variations of temperature by means of a registering thermometer 20 ins. from the ground, receiving all the heat of the direct solar rays and those reflected by the soil, exactly as in the case of plants. These observations show daily ranges sometimes approximating 40° C. (104° F). This confirms the great capacity possessed by plants for adapting themselves to wide variations of temperature.

In another series of observations made in 1911, 1912, 1914 and 1915, the amount of terrestrial radiation in the belt of air in closest contact with the soil was determined. A thermograph was placed in the open air 20 in. from the ground, and another a short distance away 55 in. from the ground, facing north, and protected from the sun and terrestrial radiation. Thus the differences in the fall of temperature, due in particular to morning radiation, were ascertained. The results are set out in a series of tables, and the following conclusions are based on them.

(1) Using two registering thermometers, A and B, at the above respective distances from the ground, the minimum daily temperature is registered by that nearest to the ground. This fact comes out very clearly, the difference often being most marked and not subject to any exceptions.

(2) The annual mean of 470 observations calculated from the monthly average minima was 19.2 degrees by thermograph A (4 ½ ft. from the ground) and 16.6 degrees by thermograph B (1 ft. 7 ½ in. from the ground).

(3) The annual average of the absolute monthly minimum was 15.7° by thermograph A and 13° by B.

(4) The absolute minimum for the 4 years was 11.6° by A and 6.4° by B.

(5) The differences between the minimums of the two thermographs in the 470 observations, taking their average and their maximum value, are summed up as follows :

(*a*) The monthly mean difference A — B was 2.3° C.

(*b*) The mean of the maximum monthly differences was 3.8° ;

(*c*) The absolute maximum difference throughout the period in question reached the high figure of 5.4°.

These results prove beyond question the importance of the study, in connection with vegetation, of the temperature changes due to terrestrial radiation, which are perfectly distinct from the general cooling of the atmosphere and occur in the lower air strata, the medium of plant life.

724 – **Soluble Non-Protein Nitrogen of Soil.** — POTTER R. S. and SNYDER R. S. (Iowa State College Experiment Station), in *Journal of Agricultural Research*, Vol. VI, No. 2, pp. 61-64. Washington, D. C., April 10, 1916. SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

The writers conclude from their researches into the nitrogenous substances of the soil that information may be obtained relative to the degree of decomposition of the organic matter in the soil by determining the proportion of nitrogenous compounds left in the alkali extract of the soil after precipitation of the protein by a suitable reagent. With this problem in

mind, they determined the nitrogen in alkali extracts of soil with or without the addition of proteins and other organic nitrogenous compounds. The proteins were precipitated by trichloracetic acid.

The principal conseqence of the results obtained appears to be that the alkali extract does not contain a definite group of nitrogenous compounds. In any case, however, the non-protein fraction remaining in solution after precipitation by trichloracetic acid may contain most of the simpler nitrogenous compounds, and therefore its determination would give an index of the degree of decomposition of organic matter in the soil.

A bibliography of 8 works completes the article.

725 - **Influence of Resin and Tannin on the Balance of Nitrogen in the Soil.** — KOCH ALFRED and OELSNER ALICE, in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 45, No. 1-5, pp. 107-118. Jena, February 26, 1916.

In previous experimentation with forest soils (deciduous and coniferous respectively) one of the writers found that in soils containing nitric nitrogen the proportion of the latter was reduced after adding tannin or resin. These two substances greatly reduced nitrification, but without stopping it completely.

Tannin and resin being important products of vegetable metabolism, it was proposed to study their influence on the soil on the basis of previous experiments. The fact that a soil fertilised with sulphate of ammonia contains only a small amount of nitric nitrogen when the above two substances are present may be explained in two ways : *a*) the two substances may unfavourably affect the nitrifying power of the bacteria ; *b*) nitrification is not impeded, but the nitrates formed are afterwards decomposed. The former hypothesis seemed the more probable, tannin and resin being used as antiseptics in leather tanning.

*Influence of Resin.* In GILTAY'S solution citric acid was replaced by resin, after which bacteria obtained either from horse dung or from the soil were put in. A few days later a reduction of nitrates by the bacteria was found to have taken place. In the same solution without bacteria no reduction of the nitrates was observed, from which it is concluded that resin exerts no chemical action on the nitrates.

In further experiments 5 gr. of resin and 0.025 gr. of sodium nitrate were added to 100 gr. of dry earth. After 4 weeks there was no further trace of nitrate in the soil. The total nitrogen content being unaltered, it is concluded that the bacteria had not decomposed the nitrate into free nitrogen, but had used it to build up their cells. This very interesting fact proves that resin, which is so difficult of solution in water, supplies energy to the denitrifying bacteria enabling them to reduce the nitrates in the soil.

The experiments were repeated both with GILTAY and RAULIN solutions, and it was found that the latter, owing to the potassium carbonate it contained, promoted the conversion of nitrates a little more than the former. The behaviour of resin in the presence of alkalies also showed that when alkalies or salts are present in the soil, the resin is decomposed into substances which can be utilised by the bacteria. Resin is therefore clearly a source

of energy to the denitrifying bacteria of the soil, and for this reason coniferous forest soils contain less nitrates than others.

*Influence of Tannin.* For 2 months the nitrification of soil samples to which 5 % and 10 % respectively of tannin + 2 grms of ammonium sulphate had been added was studied. It was found that the soil treated with 10 % of tannin contained less nitrates than that treated with 5 % of tannin, just as in the observations relating to resin. The same experiments also showed that the organisms which converted the nitrates of the soil utilised tannin as a source of energy. It becomes clearly evident that a soil rich in tannin must be poor in nitrates. The studies undertaken in order to ascertain the soil organisms which utilise both tannin and nitrates disclosed the presence of a fungus, *Aspergillus niger*, sometimes accompanied by other fungi. Contrary to the general belief, this *Aspergillus* abounds in the soil, but only works under given conditions, namely when the soil is rich in tannin. It decomposes the latter and reduces the nitrates to nitrites. Sugar is the component of tannin which it uses, but there are probably others also. The presence of calcium carbonate increase its decomposing power. Like bacteria, *Aspergillus niger* uses nitrates as a source of nitrogen, and also salts of ammonia when the soil contains tannin. The latter therefore is injurious.

As *Aspergillus* converts sugar into oxalic acid, the writers investigated the influence of this acid on nitrification. Their conclusion is negative.

726 - **Adsorption of Potassium by the Soil.** — Mc Call A. G.; Hildebrandt F. M. and Johnston E. S. (J. Phys. Chem., XX, 51-63, 1916). *Journal of the Society of Chemical Industry*, Vol. XXXV, No. 4, p. 267. London, Feb. 29,1916.

To ascertain the effect of contact for a short time between a soil and a salt solution, and the influence of surface area upon the amount and rate of adsorption, an approximately five hundreth normal solution of potassium chloride was caused to percolate through a sandy loam soil, the potassium in the percolate being estimated colorimetrically. This soil was used in two different states : *a*) dried and passed through a 2 mm. sieve, and *b*) very finely ground in a porcelain-lined ball mill for 4 days. The apparatus consisted of a Pasteur-Chamberland filter tube surrounded by a brass jacket to hold the soil, the whole being enclosed in a porcelain-lined filter chamber, into which the solution was poured, and which was fitted with an air-tight cap in connection with an automobile tyre pump. The amount of potassium leached out of the soil samples by pure water was first ascertained: much more was dissolved from (*b*) than from (*a*); 20 gr. of (*a*) was treated with 250 cc. of the potassium chloride solution containing 62 parts per million of potassium, the flow was maintained at a uniform rate, and the percolate was collected in fractions of 50 cc. The amount of adsorbed potassium was then immediately found by leaching with pure water, at the same rate of flow. The amounts of potassium in the first five percolates were, 40, 36, 40, 44, and 59 p. p. m. respectively, and the corresponding amounts retained p. p. m. of dry soil were 58,124,181, 226 and 233. The leaching action of water gave 7, 11, 9, 9, 8 p. p. m. of potassium in the fractions. With soil sample (*b*), it was found very unexpectedly, that the amount of potassium

in the solution was increased and not decreased by its contact with the soil, and this increase was only partly accounted for by the solvent action of the solution on the potassium in the soil. Allowing for this correction, a potassium chloride solution containing 78 p. p. m. gave fractional percolates containing 107, 91, 82 and 92 p. p. m. of potassium. By the subsequent leaching action of water, 39, 24, 21, 18, 15 and 18 p. p. m. of potassium were removed in the different fractions. The above case of negative adsorption is probably due to the solvent (water) being adsorbed more rapidly than the solute. Positive adsorption gradually diminishing and changing to negative adsorption was observed by Williams for certain electrolytes in water with blood charcoal, but the above is the first recorded instance of initial negative adsorption.

727 – **Basic Exchange in Soils.** — RICE, F. E. (J. Phys. Chem., 20, 214-227, 1916). *Journal of the Society of Chemical Industry*, Vol. XXXV, No. 8, p. 480. London, April 29, 1916.

Soils (33 grms.) from various parts of New York State were shaken with 100 cc. of normal potassium nitrate solution, allowed to stand over-night and filtered. In portions of the filtrate the hydrogen ions were determined by STÖRENSEN's method, and the lime requirement in pounds of lime per acre was determined by VEITCH's method, while other portions were used for qualitative tests of the bases present, and titration with fiftieth normal sodium hydroxide solution. It was found that in the case of so-called "acid" soils part of the cation of the salt was absorbed, while an equivalent quantity of bases from the soil was dissolved. The extracts thus obtained showed greater acidity than the original soils. This was attributed to the formation of hydrated aluminium oxide in the hydrolysis, together with equivalent quantities of free acid, and since the latter was strongly ionised while the former was lightly ionised and possibly in a colloidal state the resultant solution was distinctly acid. Water-soluble acid was found in only two samples of acid soils. Basic (as distinguished from "acid" soils) gave up to the salt solution more base than they adsorbed, but this was attributed not to basic exchange, but to solution of excess of the base.

728 – **Relation of Carbon bisulphide to Soil Organisms and Plant Growth.** — FRED E. B. (Agricultural Bacteriologist, Agricultural Experiment Station of the University of Wisconsin), in *Journal of Agricultural Research*, Vol. VI, No. 1, pp. 1-19, 2 plates. Washington, D. C., April 3, 1916.

In previous publications by this and other scientists, data were presented to show the beneficial action of bisulphide of carbon on the soil flora. As this action varies, fresh experiments were undertaken in order to ascertain the factors in these variations. There were studied : 1) the effect of different doses of carbon bisulphide ; 2) the effect of carbon bisulphide on different plants ; 3) the effect of carbon bisulphide on different soils. Some further experiments were carried out for the purpose of simultaneously studying the effect of carbon bisulphide on higher and lower plant forms. The fresh soil used in these experiments was sieved and potted in 2-gallon jars and the moisture maintained at half saturation. 2 per cent. of commercial carbon bisulphide was poured into small holes in the soil, which were

covered immediately. The changes in the soil flora were determined at regular intervals by plate counts and dilution counts. The formation of ammonia and nitrates was also measured at regular intervals. The plants used were buckwheat, clover, corn (maize), mustard, oats and rape.

These investigations prove that the addition of carbon bisulphide to soil exerts a decided effect on the fauna and flora of the soil. This is caracterized by a temporary reduction in the number of micro-organisms. Later, an enormous multiplication of bacteria takes place and an almost parallel increase in production of by-products or soluble nitrogen is noted. The ammonia content seems to follow the curve of bacterial growth and later gives way to larger amounts of nitrate. From the evidence it seems that carbon bisulphide in soil produces an increase in soluble compounds of nitrogen and sulphur.

In Miami soil carbon bisulphide benefited the growth of buckwheat, oats, and mustard. No relation seems to exist between plant stimulation with carbon busulphide and the form of the soluble nitrogen. In non-acid soils carbon bisulphide is most beneficial to sulphur-liking crops such as mustard. In all of the experiments, except acid soils, mustard showed an increased growth from the use of carbon bisulphide. Carbon bisulphide in peaty soil greatly benefits the growth of red clover. In sand cultures plus soluble plant food carbon bisulphide favors the growth of certain plants.

The data show clearly that carbon bisulphide does not act alike in all soils or toward all crops.

The article concludes with a bibliography of 13 works dealing with this question.

729 – **The Effect of Elemental Sulphur and of Calcium Sulphate on Certain of the Higher and Lower Forms of Plant Life.** — Pitz W. (Agricultural Experiment Station of the University of Wisconsin), in *Journal of Agricultural Research*, Vol. V, No. 16, pp. 771-780. Washington, D. C., 1916.

The problem of sulphur and sulphates in agriculture is still far from being solved, especially as regards their action on micro-organisms. In order to study this phase of the problem, 3 series of experiments were planned: 1) and 2) to note the effect of sulphur and sulphates upon the soil micro-organisms and upon pure cultures of legume bacteria; and 3) to note the effect of sulphur and sulphates on the growth of red clover (*Trifolium pratense*). For the experiments with mixed cultures fresh soil was used as an inoculum. For legume bacteria all materials were sterilised, and the nutrient medium was inoculated with a pure culture of bacteria from the nodules of red clover.

The various experiments show that calcium sulphate added to the soil has no perceptible effect on the total number of bacteria growing on gelatine plates, and does not materially affect the production of ammonia or nitrates (1). Large quantities of elemental sulphur, on the other hand, reduce the total number of bacteria growing on gelatine plates, while the addition

(1) See *B.* Feb. 1916, No. 144. (*Ed.*)

of 0.05 % of sulphur to the soil increases ammonia formation. Parallel with this increase there is a reduced formation of nitrates, which is probably due to the acidity or toxic effects resulting from oxidation of the sulphur.

Calcium sulphate stimulates the growth of pure cultures of red clover bacteria, both in nutrient solutions and in soil extracts. The increase is the same with 0.01 % as with 0.1 %. The growth of the clover roots is therefore as strongly stimulated by calcium sulphate in a quantity of 0.01 % as in quantity of 0.1 %. In small proportions calcium sulphate increases the production of red clover, as well as the formation of the nodules, while concentrates of 0.05 to 1 % do not stimulate stronger growth. The application of elemental sulphur to a clayey-sandy soil, both in quantities of 0.01 % and above, stimulates the growth of red clover, though not very much, without perceptibly affecting the growth of the roots or the nodules.

To sum up, according to the above experiments calcium sulphate produces no marked effect on the bacteria usually found present on gelatine plates. Nor does it stimulate the greater growth of the legume bacteria in pure cultures. It does, however, increase the production of red clover, the growth of its roots and the number of their nodules. On the other hand, the addition of sulphur increases ammonia formation, but reduces the total number of soil micro-organisms. It slightly stimulates red-clover production, but has no influence on the growth of its roots and the number of their nodules.

730 – **Factors influencing the Survival of Dried Soil Micro-organisms; Effect of Soil Solution.** — GILTNER W. and LANGWORTHY H. V. (Michigan Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. V, No. 20, pp. 927-942. Washington, D. C., 1915.

Publications on the above subject mention generally known facts, especially with regard to the survival of the spores, but devote no attention to the effect of various types of soils on the survival of the organisms dried therein. With the object of remedying this deficiency, the present writers undertook a series of experiments for the following purposes :

(1) To determine whether a micro-organism (*Pseudomonas radicicola*) can be protected by the solution in which it is suspended before being dried in quartz sand. In the first experiment the effect of saline physiological solutions with or without the addition of organic compounds was studied. In a second experiment the effect : (*a*) of the same solutions ; (*b*) of a culture bouillon ; (*c*) of milk, was compared with that of an extract of loamy garden soil.

(2) To compare the length of life of *Pseudomonas radicicola* dried in : (*a*) quartz sand : (*b*) garden loam.

(3) To compare the changes produced in the numbers and species of micro-organisms when a watery solution of rich garden loam was dried in 5 different kinds of soil : (*a*) compost ; (*b*) sand ; (*c*) loamy sand ; (*d*) clayey loam ; *e*) clay.

The following conclusions were reached :

(1) The survival of non-sporigenic bacteria in an air-dried soil is

partly due to the hygroscopic moisture retained by such soil. This is, however, not the only factor in operation, the survival of bacteria in a soil not being directly proportional to the size of its particles and its hygroscopic moisture.

(2) The bacteria under experiment survive drying in rich garden loam longer than in sand.

(3) If, before being subjected to drying in sand, the bacteria are suspended in a watery solution of the said soil, they survive longer than if such suspension were effected in a physiological salt solution.

(4) The watery solution of the said garden soil therefore must contain substances exerting a protective effect on the bacteria dried.

731 – **New Russian Studies of Nitrogen-fixing Bacteria.** — I. OMELIANSKIJ V. L. and SOLUNSKOV M. Sur la distribution des bactéries fixatrices d'azote dans les sols russes (On the Distribution of Nitrogen-fixing Bacteria in Russian soils) in *Archives des Sciences biologiques publiées par l'Institut impérial de médecine expérimentale à Petrograd* (French Edition), Vol. XVIII, No. 5, pp. 459-482, 3 plates. Petrograd, 1915. — II. OMELIANSKIJ V. L., Fixation de l'azote atmosphérique au moyen des cultures mixtes (Fixation of Atmospheric Nitrogen by Mixed Cultures), *Ibid.*, Vol. XVIII, No. 4, pp. 338-377, 1 plate. Petrograd, 1915. — III. OMELIANSKIJ V. L., Sur les rapports entre la fixation de l'azote et la consommation de matières organiques non azotées par les bactéries fixatrices d'azote. (On the Relations between Fixation of Nitrogen and the Consumption of Non-nitrogenous Organic Substances by Nitrogen-fixing Bacteria). *Ibid.*, Vol. XVIII, No. 4, pp. 327-337, 2 fig. Petrograd, 1915. — IV. OMELIANSKIJ V. L., Sur la physiologie et la biologie des bactéries fixatrices d'azote (The Physiology and Life History of Nitrogen-fixing Bacteria), *Ibid.*, Vol. XIX, No. 2, pp. 162-208, 1 plate. Petrograd, 1915.

I. *Distribution of Nitrogen-fixing Bacteria in Russian Soils.* M. OMELIANSKIJ and MLLE SOLUNSKOV start out from the principle that the universal occurrence of a given micro-organism with clearly defined chemical functions is one of the most conclusive arguments as to the importance of such micro-organism. They give the results of their enquiries caried out in the General Microbiology Section of the Imperial Institute of Experimental Medicine in Petrograd, on the occurrence of *Clostridium Pasteurianum*, an anaerobic nitrogen-fixing bacterium, and *Azotobacter chroococcum*, an aerobic nitrogen-fixing bacterium, in the soil of the Russian Empire. The investigations were made on soils taken from different depths in 12 localities of European and Asiatic Russia. Besides these, the presence of *Clostridium Pasteurianum* only was studied in 14 samples from other localities of the Empire. The results were as follows :

(1) *Azotobacter* and *Clostridium Pasteurianum* occur very widely in soils of different characters and in the most divergent regions of the Empire. In some few cases only the nitrogen-fixing agent was isolated, for instance *Azotobacter* in the sands of the Kirghese steppes and in the peat soils in the north of European Russia (province of Archangel).

(2) The races of *Azotobacter* and *Clostridium Pasteurianum* isolated in the enquiries are clearly morphologically distinct, especially those of *Clostridium Pasteurianum.*

(3) In these experiments, the two bacteria studied exhibited a different fixing power, weaker in *Azotobacter* than in *Clostridium Pasteurianum,*

but the figures were very close (1 to 3 mgms. of nitrogen per gram of sugar decomposed).

II. *Fixation of Atmospheric Nitrogen by Mixed Cultures.* — The work of different investigators has demonstrated that in mixed cultures nitrogen-fixing is more considerable than in the case of pure cultures. On the basis of this fact and assuming that mixed cultures approximate more closely to the natural life conditions of nitrogen-fixing bacteria, M. Omelianskij studied the fixation of nitrogen in cultures of a large number of races of *Azotobacter* and *Clostridium Pasteurianum* isolated from different Russian soils, associating with them many other micro-organisms usually accompanying them in the soil. From his many experiments he concludes that :

(1) The study of the biochemical reactions by means of which the bacteria in mixed cultures fix atmospheric nitrogen is interesting in several respects, as it brings out clearly the various aspects of the natural process occurring under conditions of combined action of the different organisms.

(2) The organisms acting in combination with the nitrogen-fixing bacteria in upper soil strata are very numerous and they play an extremely important part in the life of the soil.

(3) The synergetic activity of nitrogen-fixing and accompanying microbes is, both in laboratory experiments and under natural conditions (cultivable stratum of the soil), of a different character according to the properties of the species taking part in the process and their environment. In other cases the function of the satellite organism seems to consist in fixing the oxygen of the air and in creating the anaerobic environment (for *Clostridium Pasteurianum*). The species added to the cultures of nitrogen-fixing microbes sometimes supply the compounds of carbon needed for the process of fixing nitrogen as energetic substance. In the case of the combination : *Azotobacter* + *Clostridium Pasteurianum*, the function of the former is not confined to fixing the oxygen of the air only, and consequently to creating an anaerobic envoronment for the *Clostridium*, but this combination is also useful inasmuch as it destroys the injurious products of dissimilation created by the second (chiefly butyric acid) and maintains the action of the environment (*Azotobacter* is alkaligenic and the *Clostridium* acidogenic).

(4) The satellite species may also unfavourably affect the nitrogen-fixing microbe, either through products of assimilation or by consumption of the carbon compounds needed by this microbe for nitrogen-fixing. The energetic fixation of oxygen by the satellite aerobic species creates conditions favourable to the development of *Clostridium Pasteurianum*, but at the same time hinders the growth of the *Azotobacter*, which is necessarily aerobic.

(5) The form endowed with the maximum vitality and at the same time the most common form in which combination of the nitrogen-fixing organisms takes place in the upper soil strata is that of symbiosis between the aerobic and anaerobic nitrogen fixers, principally between *Azotobacter* and *Clostridium Pasteurianum*. In spite of the opposite properties of the

two species, their synergetic activity in the upper strata of the soil results in a harmonious mutual development producing the maximum economy in consumption of energetic substances.

III. *Relations between the Fixation of Nitrogen and the Consumption of Non-nitrogenous Organic Substances by the Nitrogen-fixing Bacteria.* — For these investigations, M. OMELIANSKIJ used an artificial mixture of *Azotobacter chroococcum*, an aerobic fixer, isolated from the soil of the Institute, and *Clostridium Pasteurianum*, an anaerobic fixer, isolated from the soils of a kitchen garden in the province of Volhynia. The use of this mixed cultivation was for the same object as in the work last mentioned, a closer approximation to the actual conditions under which the simultaneous activity of the nitrogen-fixing microbes takes place in the soil.

The nutritive medium of this culture was composed as follows per 100 cc. : 80 cc. of drinking water, 20 cc. of linseed extract 5 % strength, 2 grams of dextrose, 0.1 gram of potassium phosphate, 0.05 g magnesium sulphate, 0.5 gram calcium carbonate. Dextrose was chosen as a non-nitrogenous substance because it is suitable as a food both for *Azotobacter* and *Clostridium*.

On the 6th April 1911, this food mixture was poured into 27 Vinogradskij flasks at the rate of 100 cubic centimetres to each ; 3 flasks were then left as controls in order to ascertain the quantity of nitrogen and sugar, and 24 were sown with the mixture of the two bacteria. During these experiments, which lasted 6 weeks, the flasks were maintained at a temperature of 21°-22° C. Every 5 days, 3 flasks were taken, in order to determine sugar in one by the Bertrand method, and nitrogen in the two others by the Kjeldahl method.

The principal results of the chemical analyses are grouped in the appended diagram, which brings out clearly the most interesting facts ascertained by the researches, namely, the existence of a close relation between the process of assimilation and that of dissassimilation in the cell, which leads to its organic growth. In this diagram, the ordinates exhibit the quantity of nitrogen fixed in milligrams and that of sugar decomposed in grams. The abscissae indicate the duration of the experiments in days.

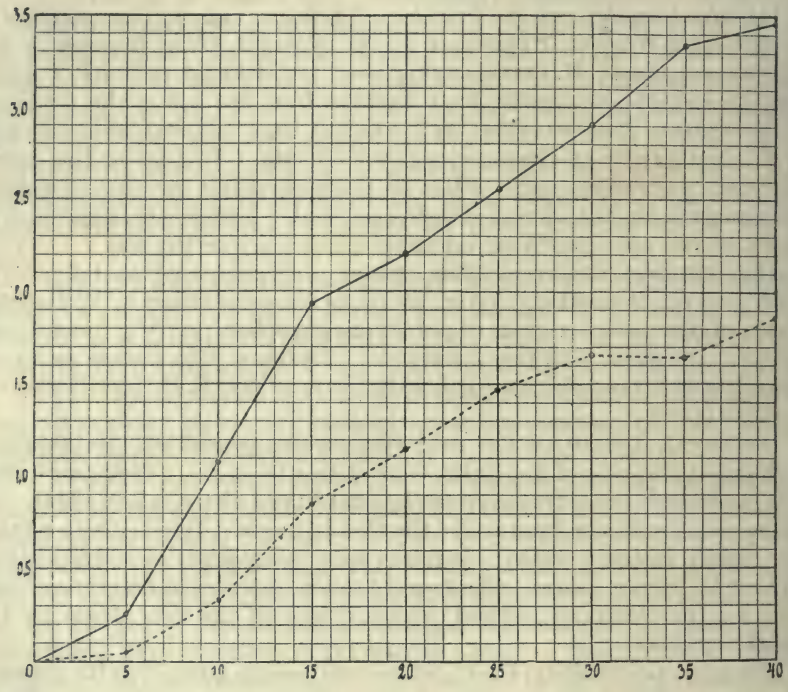
On closer examination of the results obtained, it may be said that the process of fixation of nitrogen ran its course uninterruptedly until the available energetic substance was consumed.

The quantity of nitrogen fixed is relatively small (1.735 mgrms of nitrogen per gram of sugar decomposed), which must be put down to the low degree of activity of the bacterial strains employed in the experiments.

The curves of nitrogen fixed and sugar decomposed are generally parallel. They show a continuous increase throughout the experiment, the maximum rise taking place in the period between the 5th and 15th day.

A comparison between the productivity of the work of the bacteria at different periods (of 5 days each) of their life presents some interest. Completing the data of the diagram, it is found that the process of nitrogen fixation is at its best in the first period. The absolute quantity (0.24 mg) of the nitrogen fixed during the first 5 days is insignificant, but relatively

*Curves showing the Fixation of Nitrogen and Decomposition of Sugar in mixed cultures of Azotobacter chroococcum, and Clostridium Pasteurianum.*




——— Gradual increase of the nitrogen fixed

..... Increase of the sugar decomposed.

to the quantity of sugar consumed, it represents the greatest degree of efficiency. The efficiency of the bacteria declines rapidly during the three following periods, after which, during the final period, it remains at nearly the same level. It may be said therefore that during the first periods of growth of the bacteria in question in the non-nitrogenous medium, that is to say, when the cells of the nitrogen fixers multiply energetically, their work is most efficient. The impression of the low efficiency of the work of these microbes gained from examining the ratio $\frac{+N}{-C}$ at the close of the experiment must be due to the depressing influence resulting from the process being in its last stages.

IV. *Physiology and Biology of Nitrogen-fixing Bacteria.*— M. OMELIANSKIJ has endeavoured to make a digest of the large amount of information contained in the literature, not systematised hitherto, in relation to the physiology and biology of *Azotobacter chroococcum*, supplementing them by his own researches. He deals with the following questions : methods of accumula-

tion of *Azotobacter* in cultures (selected cultures); methods employed to isolate it; its growth in different solid and liquid nutritive media; influence of temperature, aeration, etc. He devotes his chief attention to the problem of the fixation of free atmospheric nitrogen, and in particular the conditions ensuring the highest efficiency of the species under study, with reference not only to the absolute quantity of nitrogen fixed, but also to the quantity of non-nitrogenous substances oxydised.

732 - **Method for the Estimation of Hygroscopic Moisture in Soils.** — HAIGH W. D. (Sci. Proc. Roy. Dublin Soc., XIV, 529-534, 1915). *Journal of the Society of Chemical Industry*, Vol. XXXV, No. 4, p. 266, London, Feb. 29, 1916.

The ordinary method of determining the hygroscopic moisture (*i. e.*, the water left after air-drying) in a soil by heating it at about 100° C. for 12-24 hours, gives high results owing to the loss of volatile matter other than water. The method now proposed, which gives lower but strictly consistent results, consists in shaking the soil with powdered calcium carbide and measuring the acetylene evolved in a nitrometer. The mixing vessel is a thick glass tube shaped like a Kjeldahl flask but with a bent neck; a small test tube fits into the neck but cannot pass the bend. The carbide (about 3 times the weight of soil) is first placed in the bulb : the small tube with the soil is inserted in the upper, bent portion which is kept horizontal; and then the flexible joint is connected to the nitrometer. The tube is tilted to empty the soil on to the carbide, and the mixture is shaken; the acetylene comes off rapidly and can be measured within a few minutes. A blank experiment should be performed with ignited sand and a known weight of water. As found by other workers, the volume of acetylene liberated from 0.018 grms. of water measured 10.5 cc. instead of the theoretical 11.2 cc. The combined water contained in the hydrated silicates of a soil is practically unaffected by the carbide.

733 - **The Reaction of Soil and Measurements of Hydrogen-Ion Concentration.** — GILLESPIE L. J. C. (J. Washington Acad. Sc., VI, 7-16, 1916). *Journal of the Society of Chemical Industry*, Vol. XXXV, No. 4, p. 266. London, Feb. 29, 1916

The reaction of a soil should be studied from the standpoints of quantity of acid substance, and of intensity of the acidity. The amount of lime, or other neutralising materials required to correct acidity, depends upon the first, but probably the characteristic effects of acidity upon fertility are more clearly correlated with the latter, which can only be measured by determining the hydrogen-ion concentration. Twenty-two soils of seven distinct types were investigated from this point of view, both by the electrometric and colorimetric methods. In both of these the soil was air-dried, passed through a coarse sieve, and then mixed with twice its weight of water. The electrolytic vessel, which was shaken continuously throughout the determination, contained a platinum electrode coated with palladium, as a means for filling the space above the suspended soil with pure hydrogen, and at its base a stop-cock to connect the liquid with a saturated solution of potassium chloride. The difference of potential between the platinum and a saturated potassium chloride calomel electrode was found by means of a very sensitive voltmeter.

In the colorimetric method, the liquid was first centrifuged, and after the indicator solution had been added, the colour produced was measured by comparison with that of a solution of known hydrogen-ion concentration. The indicators used were methyl red, the sodium salt of phenolsulphone-phthalein, phenolphthalein, the recently prepared tetrabromophenolsulphone-phthalein, dipropyl red, and bromothymol sulphone-phthalein. Each soil sample was tested with two of these indicators. The results were in close agreement with one another, and with the electrometric determination. The hydrogen-ion concentration expressed as the hydrogen-ion exponent of SÖRENSEN, varied from 4.4 to 8.6, the exponent 7 indicating neutrality. The application of the colorimetric method to soils under field conditions is now being investigated.

MANURES AND MANURING

734 – **Relation of Green Manures to the Failure of Certain Seedlings.** — FRED E. B (Agricultural Bacteriologist, Agricultural Experiment Station of the University o Wisconsin), in *Journal of Agricultural Science*, Vol. V, No. 25, pp. 1161-1176, 2 plates Washington, D. C., March 20, 1916.

In a previous report it had been shown that if green manures are turned under and cotton planted immediately, a decrease in germination may result, while if the operation is repeated three weeks later germination is perfectly normal.

With a view to studying this phenomenon, fresh experiments in jars and in the field were made with green manures of crimson clover, in the proportion of about 1 per cent. of the soil, and with different kinds of seeds The effect of some products of decomposition, heat, bacteria and fungi was also studied.

The investigations as a whole confirmed the injurious action of green manure on seed germination. It appears to be due to some parasitic fungus (*Rhizoctonia* sp.). During the first period of decomposition of the green manure, many fungi develop, some of them having a destructive action on germs. Oil seeds in particular are very liable to be injured. Starchy seeds on the contrary are highly resistant. Cotton and soya seeds are extremely sensitive to green manure. The germination of flax, pea-nuts, hemp mustard and clover is likewise reduced, though to a less extent, by the presence of decomposing vegetable tissue. The germination of buckwheat corn, oats and wheat is not affected by green manure.

The injurious action of green manure on oil seeds is confined mostly to the first stages of decomposition. The experiments undertaken appeared to show that two weeks after the green manure has been turned in, it no longer has any serious harmful effect on the germination of oil seed. The addition of small quantities of lime appears to increase the injury to germination, the greater or less rapidity of the latter to some extent influencing the amount of such injury. Thus slow germination is marked by a high percentage of diseased seedlings.

Appended is a bibliography of 21 works relating to the question.

35 - **Hygienic, Scientific and Economic Disposal of Human Excreta.** — GARRIGOU F., in: I. *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 162, No. 17, pp. 649-651. Paris, April 25, 1916. — II. *Feuille d'Informations du Ministère de l'Agriculture*, XXIst Year, No. 18, pp. 10-11. Paris, May 2, 1916.

Various methods of sewage treatment have been proposed based on distillation of the sewage in the presence of lime, with the object of liberating ammonia, which is afterwards transformed into sulphate. The author has devised a method of sewage treatment dispensing with distillation and almost all the complicated apparatus it involves. The following is a description of it :

The solid and liquid matter are treated separately.

A) The operations on the *liquid matter* are based on the double decomposition taking place between sulphate of lime and carbonate of ammonia, and resulting in the formation of carbonate of lime and sulphate of ammonia.

The urine which has fermented sufficiently for the conversion of the urea into ammonium carbonate is emptied into a vat with water-tight bd. Finely powdered calcium sulphate (gypsum) crude or dehydrated is added, and the mixture is stirred up frequently. The lime is precipitated in the form of insoluble calcium carbonate, while the ammonia passes into the state of soluble ammonium sulphate. The liquid is allowed to settle. The calcium carbonate formed collects at the bottom of the vat, while the ammonium sulphate remains in the liquid which can be racked off.

This liquid can be concentrated in iron basins until the sulphate crystallises. It can also be absorbed by ash, sawdust, or completely dehydrated gypsum, and kept in that state until used. It gives off no disagreeable smell.

The sulphate of ammonia thus produced is very low in cost, being obtained from an ammonium carbonate derived from the urea in the urine, with the aid of sulphate of lime or gypsum which is very cheap.

In addition, the precipitated calcium carbonate, which carries with it mechanically considerable quantities of organic matter from the liquid treated, forms a manure of high market value owing to its content of organic nitrogen and other fertilising substances.

In case the whole of the ammonium carbonate in the urine has not been completely converted into sulphate by the calcium sulphate, the remainder can, by the addition of acids, be converted into nitrate or other inodorous ammonia salts, which add still more to the value of the liquid containing the sulphate of ammonia.

This mode of treatment of the liquid sewage can, owing to its simplicity, be used not only in large cities but also in small towns or villages and even on farms.

B) As regards the *solid matter*, it is separated from the liquid by settling. On reaching the works the sewage is emptied into covered and tightly closed settling basins in which the solid matter is deposited. The liquid is, after clarification, delivered into the fermentation basins, where it undergoes the operations described above.

The solid matter deposited at the bottom of the settling basins in the

form of thick mud is passed through the press filter if necessary and then put into autoclaves and heated to a temperature of 140° to 150° C. This temperature is maintained for 15 minutes, after which the steam exhaust of the autoclave is opened, and the steam passing out carries with it the ammonia salts. It passes through cool condensing coils, and is then delivered into vats containing sulphuric or nitric acid for the production of inodorous ammonium sulphate or nitrate.

In the autoclave there remains a perfectly dry, fine powder, ready for putting up in sacks, very rich in fertilising substances and completely sterilised. The condensation coils may, if necessary, be arranged at the bottom of the settling basins, so as to utilise the waste heat to increase the fermentation of the mud and produce the maximum quantity of ammonium carbonate.

The method of operation is thoroughly practical and hygienic. It ensures the maximum yield and does away with all the disadvantages of the ordinary methods of sewage disposal. Huge distillation appliances, unhealthy and repulsive smells, the expense of sterilising mixtures to be added to the sewage, are all done away with, while there is a saving in supplies of every kind, labour, plant and fuel, together with an increase in the agricultural value of the manure produced.

736 – **The Solubility of "Fluospar Slag" and Mineral Phosphates in Citric Acid.** – I. ROBERTSON G. S. The Influence of Fluospar on the Solubility of Basic Slag in Citric Acid. — *Journal of the Society of Chemical Industry*, Vol. XXXV, No. 4, pp. 216-217. London, 1916. — II. *Ibid.* The Solubility of Mineral Phosphates in Citric Acid, Part II (1). – *Ibid.*, pp. 217-220.

1. — During the past few years British steel manufacturers, particularly those using the basic open hearth process, have been introducing fluorspar into the furnace. Fluorspar produces a much more fusible slag and greater quantities of lime can therefore be added without making the slag too thick. Many thousands of tons of this "fluorspar slag" are produced annually and form a waste product ; one Teeside firm alone produces over 100 000 tons per annum ; certain firms even pay a few pence per ton to have the slag carried out to sea.

The peculiarity of basic slag produced by the use of fluorspar is that the solubility of the phosphate, according to the citric acid test, varies from 20-50 % instead of from 70-90 %.

Original "fluorspar slags," artificially prepared "fluorspar slags" and Tunisian rock phosphate were subjected to five consecutive half-hour extractions with 500 cc. of 2 per cent citric acid. The results clearly show that the citric acid test gives no true idea of the solubility of the phosphate in "fluorspar slags" and affords no guide to its value to the plant.

The use of fluorspar in the manufacture of steel by the open hearth process results in the production of a phosphatic slag with low citric solubility.

Nevertheless the slag is completely soluble in citric acid if sufficient

(1) Part I, see *B.* March 1914, No. 214. (*Ed.*).

ime is spent on the extraction. The phosphate or phosphates which the lag contains do not appear to be in combination with silica and they seem o bear a very close resemblance to those contained in mineral phosphates.

At the present time there is a very big demand for phosphatic manures, nd if temporary difficulties, such as a lack of railway facilities and shortage f bags, could be to some extent mitigated there is no reason why these ow citric soluble basic slags should not be placed on the agricultural market t a tempting price (1).

II. — The citric solubility of several classes of mineral phosphates has been determined and also the effect, upon the solubility of the phosphate, f fineness of grinding and calcining.

*Citric Solubility of Rock Phosphates.*

| Phosphoric acid dissolved. | Makatea refuses 1 mm. sieve. | Makatea passing "100" sieve. | Calcined Makatea passing "100" sieve. | Florida land pebble refuses "30" sieve. | Florida land pebble passing "100" sieve. | Calcined Florida land pebble passing "100" sieve *. | Algerian passing "100" sieve. | Calcined Algerian passing "100" sieve *. | Gafsa passing "100" sieve. | Calcined Gafsa passing "100" sieve *. | Belgian passing "100" sieve. | Calcined Belgian passing "100" sieve *. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | per cent | per cent | per cent | per cent | per cent | per cent | per cent | per cent | per cent | per cent | per cent | per cent |
| st extraction . . | 3.93 | 9.25 | 6.58 | 4.00 | 6.18 | 6.01 | 6.65 | 3.33 | 10.15 | 5.20 | 1.95 | 7.80 |
| nd extraction . . | 3.66 | 8.26 | 6.32 | 3.81 | 5.83 | 6.77 | 6.48 | 4.36 | 8.18 | 6.55 | 5.65 | 6.98 |
| rd extraction . . | 3.47 | 7.54 | 5.55 | 3.63 | 5.46 | 6.63 | 5.35 | 3.78 | 5.60 | 5.77 | 5.78 | 6.20 |
| th extraction . . | 3.28 | 6.03 | 4.63 | 3.23 | 5.14 | 5.41 | 4.00 | 3.10 | 1.93 | 4.49 | 4.95 | 4.53 |
| th extraction . . | 2.91 | 4.22 | 3.79 | 3.00 | 4.31 | 3.88 | 2.47 | 2.29 | — | 2.29 | 1.99 | 3.08 |
| Total extract . | 17.25 | 35.30 | 26.87 | 17.67 | 26.92 | 28.78 | 25.45 | 16.86 | 25.86 | 24.30 | 30.32 | 46.52 |
| Actual total . . | *38.90* | *38.24* | *38.24* | *33.27* | *31.50* | *31.50* | *27.27* | *27.27* | *25.35* | *25.35* | *19.80* | *50.55* |

* Free lime removed by sugar solution.

The results undoubtedly show that mineral phosphates are completely soluble in 2 % citric acid if a sufficient number of extracts are made. In the majority of the rock phosphates examined five extracts removed 90-100 % of the phosphoric acid present.

Even a small amount of free lime or calcium carbonate decreases substantially the solubility of mineral phosphates as judged by the citric acid test. When a large amount of calcium carbonate or free lime is present, the citric acid test, as commonly practised, is a test for lime and not for phosphates. It is important in this respect to distinguish between free lime and calcium carbonate, and lime actually entering into the composi-

(1) See *B.* Aug. 1915, No. 796; also *B.* Oct. 1915, No. 1010; *B.* Jan. 1916, No. 147 and *B.* Feb. 1916, No. 149. (*Ed.*).

tion of the phosphate. The higher the percentage of lime actually entering into the phosphate compound, the higher the citric solubility of the phosphate.

Fineness of grinding affects the total citric solubility of the mineral phosphates (judged by 5 extracts) to the extent of approximately 10 % decrease for each of the gradients : passes " 100 ", refuses "100 ", refuses " 60 " and refuses " 30 " sieve.

With one exception calcining produces a marked decrease in the citric solubility of mineral phosphates. The longer the calcining continues the more insoluble does the phosphate become.

The results judged as a whole confirm the conclusion of the former investigation (Part I, above quoted), namely, the worthlessness of the citric test as a means of establishing the relative value to the plant of phosphate manures. Rock phosphates are quite as soluble in a 0.25 per cent hydrochloric acid solution as basic slag, and there is just as much reason in favour of using a weak solution of a mineral acid for a solvent as there is for using a 2 per cent. citric acid solution. According to the writer it would be absurd to consider basic slag as of no agricultural value because it is insoluble in water, and it is equally absurd to condemn mineral phosphates because they are not so soluble in citric acid as basic slag. There can be little doubt that, as a source of phosphoric acid for the plant, rock or mineral phosphates are just as valuable as basic slag.

737 – **Potash in Banana Stalks and Skins.** — Ellis R. H.— I. Potash in the Banana Stalk in *Journal of the Society of Chemical Industry*, Vol. XXXV, No. 8, pp. 456-457. London April 29, 1916. — II. Note on the Presence of Potash in Banana Skins. *Ibid.*, No. 9 p. 521, May 5, 1916.

I. — When making an examination of the banana stalk with a view to the use of its fibre for paper-making, Mr. Ellis found the juice of the stalk to be markedly alkaline. He therefore made an analysis, and found a large percentage of potash, and practically no soda. Another analysis was made by Mr. Hanley, of the Agricultural Department of Leeds University. The figures of both analyses are reproduced in Table I.

Table I. — *Composition of Stalk* :

| | Ellis | Hanley |
|---|---|---|
| *In original stalk :* | — | — |
| Water | 91.60 % | 92.70 % |
| Dried matter | 8.40 | 7.30 |
| Ash | 2.40 | 1.50 |
| Potash | 1.14 | 0.90 |
| *In dried matter :* | | |
| Ash | 29.90 | 20.50 |
| Potash | 13.73 | 12.35 |
| *In the ash :* | | |
| Potash | 45.90 | 59.10 |

The readings of this Table show that the dried matter of the stalk contains as much potash as does kainit.

In the juice of the stalk Mr. Hanley found 0.7 % of potash.

From the results obtained by Mr. Ellis, 1 ton of banana stalks will yield 188 lb. of dried matter containing 13.7 % of potash ($K_2O$), or 54 lb. of ash containing 47.5 % potash, or 25 lb. of pure potash. Over 4000 stalks are said to come into Leeds every week, having a total weight of 16,000 lb., representing 1340 lb. (about 12 cwt.) of dried matter as rich in potash as kainit.

In the discussion which followed delivery of the above paper to the Society, stress was laid on the importance of vegetable refuse from the markets as a source of potash, and it was proposed: 1) to set apart the refuse for analysis and treatment; 2) to analyse the ash obtained in refuse destructors, as a large percentage of it came from vegetable produce and consequently contained a quantity of potash.

II. — An analysis of banana skins gave the results contained in Table II.

TABLE II. — *Composition of Skins*

| | |
|---|---|
| *In original skin:* | |
| Water | 88.20 % |
| Dried matter | 11.80 |
| Ash | 1.77 |
| Potash | 1.05 |
| *In dried matter:* | |
| Ash | 15.00 |
| Potash | 9.03 |
| *In ash:* | |
| Potash | 57.16 |

These results are of some practical importance for the United Kingdom, which, one year with another, imports 9 million bunches averaging 180 bananas each, the skins of each bunch totalling a weight of 6.8 kg; thus it receives every year 61 235 tons of skins containing 7226 tons of dried matter with 9 % of potash. Besides this, the 9 million stalks weighing 1.8 kg each on the average, or 16 328 tons aggregate, supply 1372 tons of dried matter with 13.7 % of potash.

738 – **Waste of Tobacco Ash.** — BURRELL B. A., in *Chemical News*, Vol. 113, No. 2949, pp. 255-256. London, June 2, 1916.

The fact is recalled that the ash of tobacco, in the various forms in which the latter is smoked, represents on the average 30 % of the burnt leaf and contains 20 % of potash and 5 to 6 % of phosphoric acid. If hotel proprietors and restaurant keepers had tobacco ashes methodically collected, they would be rendering a service to the country in connection with the potash problem, and at the same time making a profit for themselves.

It is found that:

A cigar weighing 106.5 grains will give about 32.3 grains of ash, of which 6.5 grains is potash;

A cigarette weighing 27 grains will give 8.5 grains of ash, of which 1.75 grains is potash ;

A pipe holding 25.5 grains of tobacco will give 8 grains of ash with 1.6 grains of potash.

The results of systematic collecting of tobacco ash and unburnt tobacco also show that tobacco ash and unburnt tobacco from :

1) the smoke-room of a club, collected for eight days, weighed $9^3/_4$ ounces.

2) the lounge of a large hotel, collected for four days, weighed 13 ounces.

3) a large restaurant, collected for 10 days, weighed 2 lbs. 8 ozs.

4) a music hall, one tenth part of the auditorium, one performance only, weighed 4 ounces.

The tobacco consumed in the United Kingdom during the financial year 1913-1914 was 98,412,412 lbs.; the cigars imported weighed 1,331,802 lbs. This would give a total consumption of 44,529 tons, which would represent 13,359 tons of ash. Reckoning the latter quantity as kainit with 12.5 per cent. of potash, it would represent 21,376 tons of kainite worth nearly £ 51,000. In the spring of 1915 it was worth nearly three times as much.

739 – **The Question of Sulphate of Ammonia in Russia.** — I. KALINSKIJ B., Sulphate of Ammonia and Nitrate of Soda, in *Земледѣльческая Газета* (The Agricultural Gazette), No. 4 (120), pp. 85-88. Petrograd, 1916. — II. Circular of the Department of Agriculture, in *Подольскій Хозяинъ* (The Agriculture of Podolia), No. 9-10, p. 38. Vinnitza, 1915. — III. Circular of the Agronomic Institute of Moscow, *Ibid.*, No. 11-12, pp. 44-45. Vinnitza, 1915. — IV. MAKRINOV, J. A., New Method of hastening Nitrification, in *Земледѣльческая Газета.* (The Agricultural Gazette), No. 8 (124), pp. 198-201; No. 9 (125), pp. 224-227. Petrograd, 1916.

I. — The production of sulphate of ammonia in Southern Russia, where this industry is almost entirely concentrated, has during the last few years increased parallel with the development of the coke industry in the basin of the Donetz :

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| In 1911, | the | production | was | . . . . . | 491 | metric | tons |
| In 1912 | " | " | " | . . . . . | 4 013 | " | " |
| In 1913 | " | " | " | . . . . . | 13 808 | " | " |
| In 1914 | " | " | " | . . . . . | 17 176 | " | " |

In 1915, this production reached 16 380 metric tons, and stocks at the end of the year amounted to 24 570 tons. It is anticipated that the production for this year will be 32 760 tons, so that this year Russia will have at its disposal about 57 330 tons of sulphate of ammonia (24 570 tons in stock and 32 760 tons manufactured in 1916).

Before the present war, almost the whole of the sulphate of ammonia was exported. It high price precluded its use as a fertiliser in Russia. Exportation having been stopped by the war, the price dropped to 29 francs per quintal (220 lbs). Importation of nitrate of soda being also suspended, Rus-

sian agriculture will be able to make use of a considerable part of the sulphate of ammonia. If the prices go down to between 24.5 and 19.5 francs per quintal, the utilisation of this manure even for cereal crops is perfectly certain, according to the Agronomic Institute of Moscow.

M. KALINSKIJ, in discussing whether Russia can now allow exportation of its sulphate of ammonia or should prohibit it, makes the following calculations for 1916 : agriculture requires 27 846 tons ; industry 16 380 tons and 4 914 tons must be kept in stock ; making in all 49 140 tons. The quantity available for export would therefore be about 8 190 tons. The forecasts of consumption of sulphate of ammonia in Russia are based on that of nitrate of soda, which according to private but reliable data, was about 24 570 tons, distributed as follows (before the war):

| | | |
|---|---|---|
| Poland and Lithuania (except the government of Vilna) | 30 % | 7 370 tons |
| Baltic Provinces (and government of Vilna) | 25 % | 6 145 " |
| Kiev sugar beet growing region | 30 % | 7 370 " |
| Rest of Russia | 15 % | 3 685 " |
| | 100 % | 24 570 tons |

II and III. — The problem of the utmost possible utilisation of sulphate of ammonia being of great importance to Russian agriculture, the Department of Agriculture called the attention of farmers, agricultural associations and the zemstvos to the necessity for active propaganda in favour of this fertiliser. The Agronomic Institute of Moscow took steps in the same direction, and emphasised the necessity for collective purchases of sulphate of ammonia by the zemstvos and by agricultural associations. The Department of Agriculture has also instructed Prof. VOLOKITINE, Director of the School of Technical Chemistry at Petrograd, to undertake test experiments on the method of Professor MÜNTZ (nitrification of sulphate of ammonia in peat).

IV. — M. MAKRINOV deals with this latter question. After briefly reviewing the most recent results of sewage water purification, on the method of " activised " mud, he states that: 1), thanks to the action of the " activised " mud and the continuous passage of air, a very rapid conversion of ammoniacal compounds takes place parallel with a rapid decomposition of the complex organic substances ; 2) the action of the " activised " substance and continuous passage of air enable the process of nitrification to be carried on in an isolated and very intense form, which may be utilised for the practical purpose of converting the large stocks of sulphate of ammonia into saltpetre.

740 – **Manuring Tests with the New Nitrogenous Manure " Guanol ", in Germany.** — KOCH, in *Fühlings landwirtschaftliche Zeitung*, 65th Year, No. 5-6, pp. 145-158. Stuttgart, March 1-15, 1916.

Manuring tests were carried out to ascertain whether the good results given up to now by " Guanol " (treacle residue mixed with peat dust and sown with *Azotobacter*) (1) are not chiefly due to the bacte-

(1) See *B.* December 1915, No. 1257. (*Ed.*)

ria contained in the peat dust. In order to test the fertilising power of the peat dust, it was used in the place of " Guanol " in 2 series of experiments, and in a third it was replaced by nitrate of soda with a view to comparing the effects of the two forms of nitrogen. A trial was also made with " Guanol " sterilised at 100° C. to study the behaviour of the bacteria.

The manure employed contained not more than 1.6 grams of betain per 100 gms. of dried matter, so that 88 % of the betain had been converted by the bacteria at the time of manufacture. It was free from superphosphate, and contained : 48.3 % of dry matter, 3.77 % of nitrogen.

The tests were made with buckwheat, vetches, oats, beet, etc., in pots manured with quantities corresponding respectively to 364,607 and 1215 lbs per acre.

The tabulated results show that the peat dust added to treacle lees slightly reduces the fertilising power of the manure. The nitrogen in the peat exerts no action, the nitrogen of the lees being alone active.

Sterilised " Guanol " gives the same yield as when unsterilised, which proves that the bacteria in " Guanol " have no specific influence on the growth of the plant, at any rate where the soil is rich enough in humus. These experiments will be repeated in soils poor in organic matter. Possibly too the sterilisation was not complete enough to destroy all the bacteria of " Guanol ".

In the 3 series where a dressing was applied in the proportion of 364, 607 and 1215 lbs of " Guanol " per acre, an increase in yield was obtained proportional to the increased quantity of manure. The nitrogen in the " Guanol " however does not act so well as the nitrogen in nitrate of soda, being present in slightly less assimilable forms.

The researches of the writer into the nitrification of " Guanol " showed that at the end of 8 weeks 30.04 % of the nitrogen of " Guanol " was converted into nitric acid. The nitrogen of nitrate of soda is more easily conveyed into the subsoil by water than that of " Guanol ". These enquiries also proved that the specific bacteria of " Guanol " do not promote ammonification or nitrification to any great extent.

Other manuring tests undertaken on grass-lands, grain crops, beets, etc., are not yet completed.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS.

741 - **Studies on the Root System of Plants, in Reference to Selection and Drought Resistance.** — Modestov A. P. : I. Differences in the Dimensions of the Root System in different Types of Cultivated Plants, in *Корневая система травянистыхъ растеній* (Root System of Cultivated Plants), Part I, pp. 11-44 + 2 tables + 3 plates. Moscow, 1915. — II. Depth reached by Roots under normal Conditions of Growth. *Ibid.*, pp. 46-80 + 14 tables and diagrams. — III. Contribution to the Study of the Root System of Flax. *Ibid.*, pp. 101-118 + 1 table + 1 diagram.

Remarkably little study having been devoted to the underground portions of plants as compared with the parts above ground, the writer undertook a series of methodical investigations of the root system of herbaceous plants, cultivated and wild, in the laboratories and experimental Stations of the Agronomic Institute of Moscow, with the assistance of the Department of Agriculture. The starting point in these enquiries was the fact,

established by the researches of DEHÉRAIN, MONVOISIN and KOSOROTOV, that there is a relation between the depth to which plants extend their roots and their resistance to drought. Assuming, therefore, within the limitations of a given species, the plants most resistant to drought are those which possess among other things a root system carried to a greater depth, stress is laid on the need for the following :

1) Statistical investigations of the depth reached by the roots of all plants, cultivated and wild, of interest to agriculture ;

2) Investigations into the " metric differences " (i. e. in length and weight) of the root system of the different species and varieties of cultivated plants.

3) Investigations into the fixation and the increase by selection of the power of deep root growth.

INVESTIGATIONS INTO THE ROOT SYSTEM OF OATS, WHEAT, FLAX AND PEAS. — These were carried out in 1914, in wooden boxes of 2 different sizes : (1) big boxes with 0.162 square metres base area (0.18 × 0.09m.) and 1.77 m. in height, used for plants which were brought to maturity ; (2) Small boxes (0.162 sq. metres base area and 0.88 m. height) for the plants removed in the 1st phase of vegetation. The soil was taken from the upper strata of the fields of the Institute. The roots were washed by a jet of water delivered by a pump, and afterwards numbered and straightway put into formalin where they remained until the winter, when they were dried and studied.

The plants taken out of the formalin were washed with water to remove any disagreeable smell, afterwards dried on cardboard, and their aerial and underground parts were then measured and weighed separately for each box. The roots for successive soil layers of 25 cm were also measured, in order to determine the amount of roots in each layer. The resulting data were divided by the number of plants in each box, and this result multiplied by 100, so as to reduce all measurements to one unit, the weight of 100 individuals. The measurements of the length of the aerial and underground parts were alone taken in calculating the maximum, but they are sufficient in view of the preliminary nature of the investigations.

At the beginning of June there were sown : 10 varieties of oats, 8 of spring wheat, 4 of flax and 3 of peas; for each variety 4 boxes were used, 2 large and 2 small, so as to have 100 tests in all. The seeds were taken exclusively from the *pure lines* obtained at the selection Station of the Agronomic Institute of Moscow, because the preliminary studies carried out with commercial oat seeds had given very divergent results as regards downward growth of the root system. In this connection mention may be made of the tests in the open field carried out by the writer in 1915, with pure lines of flax, at the flax selection Station. The depths of the roots for a given line was studied in a considerable number of individuals (100) and over an area of some square metres ; it was found that the maximum depth and spread of the roots in the different soil strata was everywhere the same; the maximum depth of the roots ranged from 44 to 53 cm. between one plot and another. In other words, tests have shown that there is a

synchronal constancy in the downward growth of the root system in individuals of the same pure line (of flax).

The enquiries of the writer into the length and weight of the root systems of oats, wheat and flax establish a *clear and essential difference between the length (and weight) in different forms of oats, spring wheat and flax.*

Table I summarises the most important results of the investigations in relation to oats.

The difference between root-length in the different varieties of oats therefore varies greatly, with a maximum of about 1 metre (186.0-101.0 = 85 cm). Then, on comparing the root-lengths with the time of ripening, MODESTOV notes an interesting fact : the longer the roots, the greater the time required for ripening. In other words, the length of the roots is proportional to the length of life of the plant. The author explains this phenomenon by saying that early varieties develop during the summer

TABLE I. — *Results of Investigations into the Root System of Oats.*

| Numbers of varieties | Length ot Roots | Total weight of underground parts of 100 plants | Name of variety from which the pure line was selected out | Ripening |
|---|---|---|---|---|
| A – 337 I. . . . . | 186 cm | 45.56 g | « Gudan » (*Avena diffusa* var. *brunnea*) | Late |
| A – 305 I. . . . . | 178.5 | 70.85 | « Ghigantskij rasviesistij » (*A. orientalis* var. *flava*) | Medium late |
| A – 331 c. . . . . | 170 | 49.40 | « Bielianka » (*A. diffusa* var. *mutica*) | Medium |
| A – 329 c. . . . . | 156 | 40.73 | « Khersonskij Rukhlik » (*A. orientalis* var. *obtusata*) | Fairly early |
| A – 4020 . . . . . | 150 | 53.20 | « New Market » (*A. diffusa* var. *trisperma*) | Medium |
| C – 4160 . . . . . | 138 | 97.65 | « Scotch Angus » (*A. diffusa* var. *mutica*) | Medium late |
| A – 317 c. . . . . | 137 | 35.54 | Australian Oat (*A. diffusa* var. *aristata*) | Early |
| A – 4114 c . . . . . | 101 | 29.90 | Nemertchansk Oat (*A. diffusa* var. *mutica*) | Very early |

period when the moisture has not yet passed through the deeper strata of the soil, and the roots, being able to find an adequate quantity of it, need not lengthen out. This property, peculiar to early varieties (short-root system), has been fixed by heredity and asserted itself in the cultivations in boxes, i. e. in an environment different from the natural one. In the varieties which ripen later, things happen differently : the plants develop in the period when the moisture has already traversed the deepest strata,

and they are compelled to push out their roots in order to get at it. In this case again the peculiar property of the variety (long-root system) has been fixed by heredity and asserted itself in the trial cultivations.

In addition to the length of roots, there were also studied : the total weight of the plant, the weight of the overground and underground parts separately, the distribution of the root stock in the different strata of the soil. As regards the weight, it is found that the length of the root system is not proportional to its total weight (see Table I) and that, in the majority of cases, the roots, when increasing in length, show a relative reduction in weight. With respect to the distribution of the roots in the different layers (25 cm each) it varies greatly (as stated above) according to the variety. On comparing the different varieties, however, it was found that No. 305 I for instance has long roots which are more abundant in the tilled stratum of the soil than those of another kind with long roots, a fact which must unquestionably be of very great importance.

The studies of the other plants, spring wheat, flax and peas, as regards difference of root lengths in the different varieties, confirmed the results obtained with oats, which will probably also hold good for other cultivated plants. For instance, *Triticum vulgare* var. *ferrugineum* No. III has roots 90 cm in lengh, while those of *Triticum dicoccum* var. *farrum* attain 182 cm. The studies of flax were repeated in 1915 in boxes (they were unsuccessful owing to the hail) and in the field. They bore on : (1) the " metric differences " of the root system in the different pure lines of the plant ; (2) the constancy of depth of roots within the limits of the pure line ; (3) the influence of different soils and water (water cultures) on the growth of the root system ; (4) the influence of moisture on the development of the root ; (5) the development of the root at different vegetative periods ; (6) the daily growth of the roots ; (7) the influence of the depth of seed-planting on the development of the roots ; (8) the root system of the principal weeds in flax fields ; (9) the stereometric distribution of the roots in the soil. The most important results are as follows :

Flax grown for fibre generally has a weaker and shallower root system than that grown for seed ; if the root of the second kind reaches a depth of 70 cm, that of the first does not exceed 40-57 cm. Moreover, the roots of the seed flax are more robust, coarser and closer, a fact explained by the southern origin of this plant, which endeavours to adapt its roots to an inadequate water supply. As regards root development at different periods of vegetation, 3 periods have been distinguished : (1) the initial period, when the flax plantlet has only 10 to 12 leaves; in this period the roots reach down to a depth of 21 cm., maintaining a vertical direction; the distribution of the roots in the different layers of soil is almost uniform ; (2) in the 2nd period, the beginning of anthesis, the roots reach 52 cm, and the uniformity of their distribution in the different layers disappears, the bulk of the roots lying within the limits of 20 cm, representing the depth of the first period ; beyond the second decimetre a considerable reduction in the mass of roots is observed, only the few main roots with little subdivision being found ; (3) in the 3rd period, the end of anthesis, the roots reach a depth of 65 cm

and the character of the root system is the same as in the preceding period. The growth of the roots continued after the end of anthesis (when that of the parts above ground had ceased) as was ascertained from the observations of daily development of the root system by means of " observation boxes " fitted with a glass wall. In the roots of flax there is a characteristic winding observed in all the periods of life of the plant. The influence of the depth of the seeds on the development of the root system of flax was not found so clear and decisive as in the case of oats, but differences do exist and must be taken into account in the researches.

STUDIES OF ROOT LENGTH UNDER NATURAL CONDITIONS OF DEVELOPMENT. — After reviewing the results arrived at by different investigators of the root system, with a view to co-ordinating them, the writer describes his own experiments carried out on a plot of the experimental field of the Agronomic Institute of Moscow. He adopted the method of DEHÉRAIN. cultivation on inclined planes, modifying and completing it. He carried out cultivation : (1) on a natural soil profile by digging a trench 281.6 cm wide, and 176 cm deep, with bottom rising gradually towards the surface of the field so that the plants were not on banked-up soil, as at Grignon, but at field level : (2) cultivation on inclined planes, utilising for this purpose the embanking work carried out 40 years ago for water-regulation purposes. The length of the roots was measured at 3 different times, namely : 1) germination, 2) flowering, 3) fructification. The results are summed up in Table II, which also indicates the differences in the length of the roots in successive periods in order to bring out more clearly the behaviour of the root system of each plant.

On analysing the data of Table II, it is seen that, in their first period of life, the plants under investigation had already developed their root system to such an extent as to penetrate deeper layers than those subject to ordinary tillage.

Starting from the idea of aerial vegetative levels, the writer gives the following scheme of underground vegetative levels.

The first level, down to 44 cm. depth from the surface, comprises the root system of short-rooted plants, chiefly weeds, annual or biennial, the typical representatives of which are, for instance : *Capsella Bursa-pastoris*, *Viola tricolor*, *Thlaspi arvense* and *Berteroa incana ;* among cultivated plants, buckwheat belongs to this group.

The second level (between 44 and 88 cm. depth) is occupied by the root ends of short-rooted cultivated plants, for instance : *Sinapis*, *Linum*, *Vicia sativa*, *Pisum arvense*, etc.

The third level (88,139, 174 cm.) comprises the root ends of long-rooted cultivated plants : *Vicia villosa*, *Panicum miliaceum*, *Avena sativa* and *Solanum tuberosum*, etc.

Next there is a fourth level, comprising only the root ends of long-rooted wild herbaceous plants, as for instance : *Vicia Cracca*, *Potentilla argentea*, *Tanacetum vulgare*, etc.

Finally, the deepest level found lies between 264 and 352 cm.; it con-

TABLE II. — *Length of Roots at different Periods of Vegetation.*

| | Name of plant | 1st period: Germination | 2nd period: Flowering | 3rd period: Fructification | Differences between the 2nd and the 1st period | Differences between the 3rd and 2nd period |
|---|---|---|---|---|---|---|
| | A. – Cultivtn. on natural profile : | | | | | |
| | 1. *Avena sativa* . . . . . | 79.2 cm. | 132.0 cm. | 140.8 cm. | 52.8 cm. | 8.8 cm. |
| | 2. *Linum usitatissimum*. . . | 35.2 | 52.8 | 70.4 | 17.6 | 17.6 |
| | 3. *Vicia sativa*. . . . . | 26.4 | 88.0 | 88.0 | 61.6 | 0.0 |
| Weeds | 4. *Raphanus Raphanistrum* | 13.2 | 30.8 | 35.2 | 17.6 | 4.4 |
| Weeds | 5. *Chenopodium album* . . | 26.4 | 30.8 | 35.2 | 4.4 | 4.4 |
| | B. – Cultivtn. on embankment : | | | | | |
| | 6. *Avena sativa* . . . . . | 52.8 | 92.4 | 127.6 | 39.6 | 35.2 |
| | 7. *Panicum miliaceum* . . . . | 39.6 | 92.4 | unwashed roots | 52.8 | — |
| | 8. *Zea mays* . . . . . | 30.8 | failure | | | |
| | 9. *Lupinus albus*. . . . . | 52.8 | left till spring of 1915 | | — | — |
| | 10. *Vicia Faba*. . . . . | 35.2 | 70.4 | unwashed roots | 35.2 | — |
| | 11, *Vicia sativa* . . . . . | 30.8 | 79.2 | 83.6 | 48.1 | 4.4 |
| | 12. *Vicia villosa* . . . . . | 30.8 | 74,8 | 105.5 | 44.0 | 30.8 |
| | 13. *Pisum arvense* . . . . . | 48.4 | 74.8 | 88.0 | 26.4 | 13.2 |
| | 14. *Linum usitatissimum* . . . | 35.2 | 70.4 | 74.2 | 35.2 | 8.8 |
| | 15. *Sinapis alba* . . . . . | 39.6 | 48.4 | 70.4 | 8.8 | 30.8 |
| | 16. *Polygonum Fagopyrum*. . . | 26.4 | 48.4 | unwashed roots | 22.0 | — |
| | 17. *Helianthus annuus*. . . . . | 30.8 | failures | | | |
| | 18. *Cannabis sativa* . . . . . | 35,2 | | | | |
| | 19. *Solanum tuberosum* . . . . | 61.6 | 101.2 | 123.2 | 39.6 | 32.0 |
| Weeds | 20. *Raphanus Raphanistrum* | 26.4 | 52.8 | 52.8 | 26.4 | 0.0 |
| Weeds | 21. *Capsella Bursa-pastoris* . | not yet germinated | 26.4 | 39.6 | — | 13.2 |
| Weeds | 22. *Viola tricolor* . . . . . | not yet germinated | 35.2 | 48.4 | — | 13.2 |
| Weeds | 23. *Thlaspi arvense* . . . . | not yet germinated | 35.2 | 48.4 | — | 13.2 |
| Weeds | 24. *Chenopodium album* . . | not yet germinated | 44.0 | 44.0 | — | 0.0 |
| Weeds | 25. *Berteroa incana* . . . . | not yet germinated | 48.4 | 52.8 | — | 4.4 |
| Weeds | 26. *Agrostemma Githago* . . | 26.4 | 66.0 | 88.0 | 39.6 | 22.0 |
| Weeds | 27. *Centaurea Cyanus* . . . | 26.4 | 66.0 | 105.6 | 39.6 | 39.6 |

tains the root ends of perennial herbaceous plants as for instance the species of *Rumex*. Lucerne and some lupins also belong to this group.

On comparing the results of growing some cultivated plants (*Avena sativa*, *Vicia sativa* and *Linum usitatissimum*) on a natural profile and on banked up earth, and considering that the compactness of the soil in these two cases must be different, the Author is of opinion that, though it cannot be maintained that the compactness of the soil makes no difference to the roots, it is impossible to share the prevailing view according to which roots should penetrate deeper in less compact soils. He does not however wish to draw an *a priori* conclusion from this fact before making thorough and conclusive investigations. He confines himself to recalling what was said by HENSEN as to the importance of the tunnels left by earth-worms for the extension of roots, and he adds that a similar function is also served by the channels formed by the roots of dead plants. That is why living roots can penetrate even compact soils fairly easily. One might, he says, draw a conclusion which seems a paradox at first sight, namely that deep-rooted perennial weeds, so injurious to the farmer, may at the same time be useful in paving the way for the roots of cultivated plants, which, by penetrating deeper, are sure of success in struggling against drought, and best utilise the nutritive substances of the soil.

A special chapter contains a Bibliography of the subject (552 works); it will be completed later.

742 – **Changes in the Chemical Composition of Rye Seed through the Action of some Forms of *Fusarium*.** — POMASKIJ A. in *Министерство Земледѣлія. Бюро по Микологіи и Фитопатологіи Ученаго Комитета. Матеріалы по Микологіи и Фитопатологіи Россіи.* Ministry of Agriculture, Office of Mycology and Pathology of the Scientific Committee. Matter relating to Mycology and Plant Diseases. Part 4, pp. 77-106. Petrograd, 1915.

The initiative of continuation of the investigations relating to "pianij khlieb" ("intoxicating bread") the intoxication being caused by the products of alteration of the grain by *Fusarium*) is due to A. A. JATCHEVSKIJ, Director of the Office of Mycology, who has put forward the hypothesis that not only *Fusarium roseum*, but all forms of *Fusarium* similar both from the morphological and physiological point of view, may equally act on the grain, decomposing the protein substances and forming a toxin analogous to the supposed nitrogenous glucoside, isolated by O. GABRILOVITCH in the pure culture of *Fusarium roseum* Link on rye. On the basis of this hypothesis the writer, together with A. A. JATCHEVSKIJ and N. A. NAUMOV, carried out a series of experiments the object of which was: 1) to isolate and further study the toxin of intoxicating bread; 2) to make a chemical analysis of the mycelium of the different forms of *Fusarium*.

The present work is only the first part and contains the results of the qualitative and quantitative analysis of rye grain infested by *Fusarium*, such analysis being indispensable for further work, as was proved by the preliminary experiments on the isolation of the toxin. The material used was: pure cultures of *Fusarium* prepared in the laboratory, and the original Petrusk variety of rye infested with *Fusarium roseum* Link, coming from the

region of Ussurijsk, in Siberia ; two samples were also taken of the rye in question, infested with *F. subulatum* App. and Woll., and originating one from the province of Tula, European Russia, and the other from the region of Ussurijsk ; there were also utilised two samples of " Vasa " rye, infected with the pure culture of the above mentioned *Fusarium*, and finally, two uninfected and two sterilised samples of the same rye.

From the moment of inoculation with *Fusarium*, the culture was in a separate room away from the direct light of the sun, and kept at a constant temperature of 18-20° C. The analyses were made at the end of 10, 20, 30 and 60 days after the beginning of the experiment.

*Results.* 1) The vital activity of the two forms of *Fusarium* on the rye grains is accompanied by a large reduction of dry matter. Thus, in the analysis of the culture of *Fusarium roseum* made after 10 days, the loss of dry matter is about $\frac{1}{3}$ of the total quantity : when the experiment is further prolonged, the loss of dry matter increases, amounting to $\frac{3}{4}$ of the total on the 60th day. *Fusarium subulatum* in a 30 days culture exhibits an activity lower than that of the first *Fusarium*, but the difference afterwards disappears.

2) The dry substance lost is chiefly starch and albumin.

3) The loss of starch in one month is 61 to 80 %, and in two months 80 to 89 % of the initial quantity.

4) The vital activity of *Fusarium* is accompanied by the decomposition of albumin with loss of nitrogen. This loss is not so large as in the case of starch, being about 5 % in the culture of *F. roseum* for the first ten days. It is still less, (2.7 %) in a culture of *F. subulatum* one month old. At the 60th day, however, the losses of nitrogen for both forms of *Fusarium* increase, with an average of 12 to 16 % common to both.

5) Both forms of *Fusarium* act equally on the rye, reducing the starch and decomposing the albumin, with production of ammonia.

6) The products of splitting up of albumin, as found from the analyses made, are the following : albumoses, peptones, amino-acids, organic bases, ammonia and a toxin (presumed to be a nitrogenous glucoside). The process of decomposition of albumin was most energetic in the cultures of *F. roseum* and a little less so in those of *F. subulatum*. The numerical data in relation to the quantity of decomposition products formed allow of the following description of the hydrolysis of albumin produced by *Fusarium* : during the first month of the experiment there are chiefly formed amino-acids, organic bases, peptones, nitrogenous glucosides, and a small quantity of ammonia, while in the second month the hydrolysis grows more energetic with formation of a considerable quantity of ammonia. The practical bearing of these observations is that, for the purpose of isolating and studying the poisonous principles of " intoxicating bread ", the amino-acids and organic bases, a 3 to 4 weeks old culture of *Fusarium* may be used with absolute certainty of success.

7) The pentosans disappear fairly quickly, chiefly during the first 30 days ; during the subsequent 30 days, the loss only increases 6 to 7 % ; the total loss being 75 % of the initial quantity.

8) As regards cellulose, during the first 30 days some increase in its quantity is observable, due to energetic synthesis of chitin, which masks the loss of the crude cellulose. In the second month this synthesis slows down, and the decomposition of cellulose then becomes evident.

9) With respect to fats, the results are that, in the course of the first 30 days, their splitting up is masked by the synthesis due to *Fusarium*; in the second month, the breaking up process predominates, and a final loss of 21 to 51 % results. Under the influence of *Fusarium*, the iodine index of the fatty substance diminishes, while the acidity index increases, which means that in the splitting up of fats by *Fusarium* two processes occur concurrently; saponification of the glycerides, and oxidation of the unsaturated acids.

10) The percentage of acidity in the watery solution does not increase.

11) The quantity of mono-saccharides in the cultures of *Fusarium* is small and does not grow.

12) In a thirty days culture, no disaccharides were found which could be inverted with a 1 % solution of hydrochloric acid; after 60 days, they are present in a minute quantity (up to 0.25 %).

13) In view of the wide occurrence of "intoxicating bread" in the northern and central Governments of Russia, produced not only by *Fusarium roseum*, but by other forms of *Fusarium* also, the writer urges that the utmost attention should be given to the phenomenon in question.

743 – **Change in the Specific Gravity and in the Starch and Dry Matter Content of Potatoes during Storage.** — Szell L., in *Kisérletügyi Kozlemények* (Bulletin of Hungarian Agronomic Stations), Vol. XVIII, Part 5-6, pp. 1026-1028. Budapest, 1915.

In October 1913, two varieties of potato: "Richter-Imperator" and "Up to date" from the 1913 crop were stored, partly in heaps on the field and partly in cellars. In the cellar-stored potatoes the specific gravity and the content of starch and dry substance were determined every fortnight; the same figures for the other potatoes were determined before stacking up and after storage. The results brought out the following facts:

The specific gravity and the contents of starch and dry substance (deduced from the specific gravity) increased generally in both varieties during cellar storage, but decreased in the field-stored potatoes. It follows that it is more economic to store potatoes in well-ventilated cellars than in heaps.

The increase in specific gravity of these two varieties of potatoes stored in cellars did not take place regularly, except before the tubers germinated. This must be attributed on the one hand to the different factors acting on the stored potatoes, such as healthy condition, respiration, germinating stage of the tuber, dampness of cellars, temperature, etc., and on the other hand to the fact that the results of the different methods of determining the specific gravity are influenced by the following factors: size, shape, maturity, hollows in the tubers, structure of skin, depth of eyes, adhesion of the water to the surface of the tubers, etc.

Determinations of specific gravity repeatedly carried out on specimens of the same class (cellar-stored) proved that the divergencies between the maximum and minimum values were greater in " Imperator " than in " Up to date ". In the former the minimum content of starch was 13.9 % and the maximum 16.6 %, while in the latter the minimum content was 12.3 % and the maximum 13.9 %. Therefore the range was 2.7 % in " Imperator " and 1.6 % in " Up to date ". The difference in the range of values in these two varieties is not merely accidental, but appears to be related to the fact that in " Imperator ", especially in large tubers, big hollows occur more frequently, and this variety is more liable to rot than the other. This observation if practically applied to other varieties of potatoes might have useful results.

The variations in the specific gravity of potatoes checked by accurate analyses again confirm the fact that the usual rapid method of determination of starch and dry substance based on an estimation of specific gravity of potatoes furnishes only approximate and unreliable results.

744 – **Rapid action of Saline Solutions on Living Plants: Reversible Displacement of a part of the Basic Substances contained in the plant.** — DEVAUX HENRY, in *Comptes Rendus de l'Académie des Sciences*, Vol. 162, No. 15, pp. 561-563. Paris, April 10, 1916.

By previous studies the writer ascertained that the cell walls, and in particular the pectose they contain, are able to fix energetically an appreciable quantity of all the bases present in the form of salts. Prolonged washing in distilled water does not remove the metals thus fixed. On the other hand, steeping for a short time in the solution of another metal causes the immediate separation of the metal which distilled water had been unable to remove. These phenomena of mutual displacements are reversible. Just as alkaline metals can be displaced by all others, in particular calcium, the latter can in turn be expelled by alkaline metals.

These results at once suggested the question whether the interchanges observed on isolated cell walls also take place in living plants.

The question is answered by the following investigations :

A 10 to 15 gram lot of some aquatic plant was placed in a suitable vessel and carefully washed with distilled water (distillation carried out in glass in order to avoid the marked traces of copper or lead frequently found in commercial distilled water), after which, it was subjected to the following steepings of 30 minutes each : 1) in 250 cubic cc. of distilled water ; 2) after washing with distilled water, in 250 cubic cc. of 1 per 1000 saline solution ; 3) after careful washing with distilled water, in 250 cc. of distilled water. The liquid was tested with oxalate of ammonia after each maceration. Result : no calcium after the first and third maceration ; presence of calcium after the second maceration (in saline solution).

It follows from these experiments that a very rapid decalcifying action of the plant was produced by the alkaline salts present in the solutions employed. This decalcification is a general phenomenon, having been observed by the writer in various plants (phanerogams, cryptogams, aquatic roots, terrestrial plant roots, etc.) and with different salts. The decalcifying salt may be an alkali or alkaline earth, but it may also have any acid

radical. Any one of these salts causes the immediate separation of a little calcium, which increases as the action is prolonged, and finally represents a considerable proportion of the total weight of calcium in the plant.

It is not only calcium which is thus expelled from living plants by any other metal present in the state of saline solution. For instance, potassium is also separated on treating the plant with a calcium salt. Thus the cycle is complete for all alkaline or alkaline-earth metals. The calcium in plants is expelled by the salts of other metals, but the other metals are expelled by the salts of calcium. It is a perfectly reversible phenomenon, in which the action of the most abundant salt preponderates.

There is a remarkable similarity between the absorbent properties of the soil for saline solution and those exhibited by living plants. In both cases the fixation relates mainly to the bases, and these bases can expel each other reversibly. This forms the direct demonstration of a contention put forward by the writer in 1904; " the pectose in the walls of root hairs being in close contact with the particles of the soil, the whole together, soil and walls, forms a colloidal system having the same properties of absorption everywhere. The bases are not held and kept in reserve in the soil but also in the cell wall within immediate reach of the protoplasm ". Indeed there is nothing to show that the cell content itself does not take part in the exchanges, and this simple hypothesis shows the importance which may attach to the study of these reversible exchanges in living tissues.

745 - **The Relations between the Presence of Magnesium in Leaves and the Function of Assimilation.** — ANDRÈ G., in *Comptes Rendus de l'Académie des Sciences*, Vol. 162, No. 15, pp. 563-566. Paris, April 10, 1914.

Several authors have proved that crude chlorophyll, extracted from leaves by alcohol or benzene always furnishes an ash in the composition of which magnesium phosphate predominates ; other more recent work has also shown that magnesium is the only fixed element forming a part of the molecule of chlorophyll ; finally, MLLE MAMELI demonstrated that the quantity of pigment forming in the assimilating organs is related to the weight of magnesium supplied to the plant.

If magnesium plays so special a part in the molecule of chlorophyll, it might be expected that the weight of this element would be greater in proportion as the process of assimilation reaches greater intensity in the plants from which it is extracted. The writer therefore, at different vegetative periods, detached a number of leaves from different species of plants, dried and crushed them, afterwards extracting them by heating with ether and afterwards with alcohol. He measured the magnesium and phosphorus in the product of the extraction. He thus determined the weight of phosphorus (reckoned as $H_3PO_4$) and of magnesium (reckoned as MgO) contained per 100 grams of substance dried *in vacuo* at the different times : 1) in the part of the leaf substance dissolved in the ether and alcohol (*organic* phosphorus and magnesium); 2) in the part not dissolved (*residual* phosphorus and magnesium).

From the table giving these figures, and also the relations between organic phosphorus and residual phosphorus on the one hand and organic

magnesium and residual magnesium on the other, it is found that the absolute weight of organic magnesium increases from April to May in chestnut and lilac leaves. The maximum is reached on the 4th May in the former case, and on the 3rd in the latter. Beyond those dates this weight decreases almost regularly. With regard to the leaves of the chestnut tree the maximum weight of magnesium is reached on the 26th April. Taking on the other hand the ratio between the weights of organic and those of residual magnesium, this ratio is found to reach its maximum on the 26th May in the leaves of the horse-chestnut, on the 3rd May in those of the lilac, and not until the 14th June in those of the common chestnut. Assuming that the time when this ratio reaches its maximum corresponds, at any rate in the year under consideration, to the maximum activity of assimilation, it must be concluded that this process is most active during the whole of May in the horse-chestnut, at the beginning of May in the lilac, and between the end of May and the middle of June in the ordinary chestnut. On the other hand, on comparing the $\frac{\text{organic phosphorus}}{\text{residual phosphorus}}$ and $\frac{\text{organic magnesium}}{\text{residual magnesium}}$ a satisfactory agreement between the maxima of these two ratios is found in the horse-chestnut leaves. Although this agreement is less marked in the other two species of leaves studied, it is reasonable to assume that the maximum of vegetative activity is at the same time manifested by the elaboration of carbohydrates and the concurrent production of the organo-phosphoric compounds the existence of which is unquestionably bound up with the chlorophyll synthesis.

These experiments should be resumed subsequently on other plant species.

746 – **Comparative Tests of 4 Varieties of Barley at Torestorp, Sweden.** — HJALMAR VON FEILITZEN, in *Svenska Mosskulturförenings Tidskrift* XXXth Year; No. 1, pp. 57-60. Jönköping, 1916. PLANT BREEDING

Tests covering a period of 6 years (1909 to 1914) at the Station of Torestorp. Manure: superphosphate, 178 lb per acre (in the last years 267 lb.), potash salts of 37 % strength 178 (267) lb. per acre. The varieties tested were always sown at the same time, the time of sowing varying from the 7th to the 15th May in different years. The crops were more or less damaged by spring frosts. This was the case in 1909 and 1913. In 1910 the 6-rowed barley, an early variety, was the only one to suffer from the low temperatures.

As appears from the Table, the annual fluctuations of yield are very great. The best results were in 1911. In that year the " Svanhals " variety gave a yield of about 23 cwt. per acre. The same was the case in 1914, in which year the 6-rowed barley furnished a yield of about 23 ¼ cwt: per acre. The worst years were 1909 and 1913, with yields of 31 cwt. and 24 cwt., owing to the spring frosts which in those regions form the most frequent weather feature, and the one which does most injury to the cereal in question.

As regards the yield of grain, the " Plymage " variety furnishes the

## *Results of Tests.*

| Varieties | 1909 | 1910 | 1911 | 1912 | 1913 | 1914 | Averages |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | *Straw yields (cwts per acre).* | | | | |
| Plymage | 38 1/4 | 41 1/10 | 41 3/5 | 47 1/5 | 60 1/2 | 40 1/2 | 44 4/5 |
| Primus | 42 | 42 | 45 4/5 | 41 | 55 4/5 | 38 1/2 | 44 1/3 |
| Svanhals | 36 1/8 | 41 | 42 3/5 | 46 9/10 | 52 | 39 | 43 |
| Sexradigt | 37 | 41 3/4 | 34 | 36 | 45 1/3 | 36 3/4 | 38 4/5 |
| Averages | 38 1/2 | 41 3/10 | 40 4/5 | 42 7/10 | 53 1/3 | 38 1/2 | 42* |
| | | | *Grain yields (lbs per acre).* | | | | |
| Plymage | 1 576.41 | 2 126 | 2 440 | 2 392 | 930 1/2 | 2 176 | 1 940 |
| Primus | 1 440 | 2 044 | 2 344 | 1 906 1/2 | 829 | 1 510 | 1 679 |
| Svanhals | 1 200 | 2 136 | 2 580 | 2 302 1/2 | 990 | 2 052 | 1 879 |
| Sexradigt. | 1 429 | 996 | 2 373 | 1 980 1/2 | 1 583 1/2 | 2 625 1/2 | 1 846 |
| Averages | 1 411.38 | 1 825 1/2 | 2 432 | 2 145 | 1 083 | 2 091 | 1 836 |
| | | | *Weight of 1000 grains in grams.* | | | | |
| Plymage | 38.8 g | 41.6 g | 42.7 g | 46.6 g | 30.7 g | 46.1 g | 41.1 |
| Primus | 40.4 | 43.4 | 42.2 | 51.5 | 35.9 | 50,8 | 44.0 |
| Svanhals | 39.6 | 42.6 | 43.8 | 45.4 | 34.8 | 47.2 | 42.2 |
| Sexradigt. | 30.0 | 31.2 | 36.3 | 37.3 | 25.6 | 37.0 | 32.9 |
| Averages | 37.2 g | 39.7 g | 41.3 g | 45.2 g | 31.7 g | 45.3 g | 40.0 |
| | | | *Weight per bushel in lbs.* | | | | |
| Plymage | 41.60 | 50 | 54.51 | 52.27 | 36.32 | 52.75 | 48.90 |
| Primus | 46.18 | 51.55 | 53.07 | 52.91 | 40.89 | 52.27 | 49.46 |
| Svanhals | 45 | 49.63 | 52.75 | 50.11 | 38.08 | 54.03 | 47.78 |
| Sexradigt. | 43.30 | 42,49 | 55.32 | 53.39 | 36.24 | 52.75 | 47.30 |
| Averages | 44.02 | 48.42 | 53.9 | 52.19 | 40.43 | 52.95 | 48.38 |
| | | | *Length of period of vegetation (days).* | | | | |
| Plymage | 111 | 112 | 95 | 109 | 108 | 94 | 105 |
| Primus | 111 | 112 | 95 | 109 | 108 | 94 | 105 |
| Svanhals | 111 | 112 | 95 | 99 | 108 | 89 | 102 |
| Sexradigt. | 102 | 112 | 93 | 99 | 104 | 89 | 100 |
| Averages | 109 | 112 | 94 | 104 | 107 | 91 | 103 |

best crops on the average, while the " Primus " variety is found inferior to all the others tested. On the other hand, as regards straw yield and weight per bushel the varieties " Plymage " and " Primus " are equal, and markedly superior to the two others. " Primus " gives the biggest weight per 1 000 grains (44.0 grms.), and is followed by " Svanshals ", " Plymage " and " Sexradigt " with 32 grms. only.

Finally, the duration of the vegetative period varied from 91 days in 1914 to 112 days in 1910. The 6-rowed barley is harvested on the average, 5 days, and " Svanhals " 3 days before " Plymage " and " Primus ", which are last, and ripen simultaneously. From the results of these 6 years' tests as a whole, it may be concluded that the two varieties " Plymage " and " Svanhals ' in the region of Torestorp and in all other localities with equal climatic and soil conditions, should be preferred to the varieties " Sexradigt " and " Primus ", in spite of the excellent quality of grain marking this latter variety.

747 — **Comparative Tests with 8 Races of Oats, at Flahult, Sweden.** — HJALMAR von FEILITZEN in Svenska Mosskulturforeningens Tidskrift, Year XXX, No. 1, pp. 65-67. Jönkoping, 1916.

Comparative cultivation experiments with 8 races of white and black oats conducted in 1915 at Flahult in sandy and peaty soil.

The oats were sown on the 29th April. The frosts at the end of May and lack of rain at the time of earing, caused great damage to the sown fields and reduced the crop considerably.

Among the white races in particular, there was a high percentage of ears which were empty, or poor or inferior in quality of contents. We reproduce some corresponding data : (Table I, page 968).

Owing to the unfavourable weather, both the straw and grain yields were low. The best comparative results were obtained with the two strains of German oats for peat soil, and the worst with Klock II. The two new types of Svalof black oats were, contrary to expectation, inferior to the German oats ; the shortness of the period of observation, however, does not allow of definitive conclusions on this point. We quote the following average results :

| | Number of years of test | Straw yield per acre | Grain yield per acre |
|---|---|---|---|
| *White* | — | cwt. | lbs |
| Probsteier | 7 | 38.36 | 2 068 |
| New German light yellow oats for peat soil | 5 | 38.32 | 2 037 |
| New German golden-yellow oats for peat soil | 5 | 38.42 | 1.800 |
| *Black* | | | |
| Black German oats for peat soil | 7 | 34.79 | 2 488 |
| Klock II | 5 | 41.27 | 2 408 |
| Black Nordfinsk oats | 5 | 37.82 | 2 171 |

Among the black races examined at Flahult, the German oats lead, proving superior to the Klock, which is nevertheless remarkable for its abundance of straw. The Nordfinsk always gave unsatisfactory results and is certainly not able to compete with the other races. With regard to the

TABLE I.

| | Straw cwt per acre | Grain lbs per acre | Bad Grain lbs. % | Qualities of grain: Weight of bushel in lbs. | Qualities of grain: Weight of 1 000 grains in grams | Qualities of grain: Percentage weight of kernel % | Days between sowing and earing | Length of entire vegetative period in days |
|---|---|---|---|---|---|---|---|---|
| *White*: | | | | | | | | |
| New German light yellow oats for peat soil | 30.57 | 1 603 | 8.8 | 36.96 | 28.8 | 68.9 | 68 | 106 |
| *do.* golden-yellow | 34.27 | 1 471 | 11.4 | 37.76 | 26.0 | 68.2 | 68 | 106 |
| Probsteier | 34.56 | 1 385 | 16.1 | 36.96 | 29.2 | 67.7 | 78 | 43 |
| *Black*: | | | | | | | | |
| Black German oats for peat soil | 22.93 | 1 721 | 3.6 | 37.12 | 30.0 | 72.6 | 68 | 101 |
| Black Svalöf oats No. 01120 | 31.90 | 1 431 | 8.4 | 37.28 | 27.8 | 73.3 | 69 | 106 |
| Black Svalöf oats No. 01101 | 26.36 | 1 373 | 7.8 | 36.24 | 30.8 | 70.3 | 69 | 104 |
| Black Nordfinsk Oats | 28.05 | 1 239 | 7.4 | 37.44 | 27.1 | 71.7 | 68 | 104 |
| Klock II. | 33 | 1 070 | 19.6 | 34.79 | 28.7 | 67.9 | 76 | 110 |

white oats, the Probsteier is somewhat superior to the two German types, but the latter nevertheless represent very good varieties particularly adapted to peat soils

748 – **Strawberry Breeding in the United States.** — *The Journal of Heredity*, Vol. VII, No. 4, p. 191. Washington, April 1916.

Probably with no single fruit has more been accomplished by scientific breeding than with the strawberry. Of the 200 000 acres or thereabouts which are planted to strawberries in the United States, it is probable that 90 % are planted to varieties which have been produced during the last quarter of a century.

Strawberries have been grown in the United States ever since the country was first settled, but the original strains bore fruit only in the early summer. One of the greatest advances in the industry was the introduction of the fall-bearing or ever-bearing varieties, the first of which was Pan-American, produced by SAMUEL COOPER, of Delevan, N. Y., in 1898. This was a sport from the variety Bismarck, which bore only in the early summer. Mr. COOPER produced a number of seedlings by self-fertilization from this sport and then crossed them with each other and back on the parent. In this way a number of other more desirable varieties were obtained. Crossing Pan-American with Dunlap (Senator Dunlap), a widespread and famous variety, HARLOW ROCKHILL, of Conrad, Iowa, produced in 1908 the variety Progressive, which has proved one of the most popular in the northern States.

Dunlap itself which has long been the most widely grown northern variety, originated with Rev. J. R. REASONER, of Urban, Ill. in 1890, but was not introduced to the trade until 1900. It was the result of definite breeding.

The variety Klondike, which makes up probably nine-tenths of the area planted in the southern States, was produced as long ago as 1895 by ROBERT CLOUD of Louisiana, as a result of a carefully planned cross.

The ease with which results are got appears to be the principal reason why plant breeding has been so much more widespread with the strawberry than with any other fruit. Crosses are easily made, seedlings are easily grown, and they multiply so rapidly by runners that a large stock can be obtained in a very short time.

749 – **Sowing and Transplanting Rice on the "Dapog" Method, peculiar to some parts of the Philippines.** — APOSTOL SILVERIO, in *The Philippine Agricultural Review*, Vol. VIII, No. 2, pp. 98-102. Manila, 1915. CEREALS AND PULSE CROPS

The practice of growing 2 rice crops per year is of old standing in those parts of the Philippines where sufficient water for irrigation is always available. As soon as the first crop is taken off, the land is prepared for the second. The earliest irrigated rices are used, with the twofold object of cropping before the rainy season has fully set in, and allowing the necessary time for tillage for the main crop. Direct broadcast sowing (by hand) is the only one used for the second crop wherever it is grown in the Philippines (provinces of Tarlac, Pampagna and Laguna), except in the communes of Calanan and a small part of that of Bay (Laguna), where the special method of sowing and transplanting called "dapog" is in use. This method allows the plantlets to be transplanted without breaking them, at a younger age than with ordinary seedlings. Earliness is of prime importance for the dry season crop. It is therefore necessary to transplant *young* plants, their age having a direct influence on the period of ripening of the rice. The crop ripens later in proportion as the age of the transplanted plants is more advanced. A difference of 23 days even has been found in the time of ripening between rice transplanted on the "dapog" method and that transplanted on the ordinary method.

For the "dapog" method the seedling plot requires neither special soil nor special tillage. It is tilled with the rest of the rice field. It must, however, lie near the water channel, so that the water should have no time to get hot, during the hours of great heat, and scald or otherwise injure the germinating seeds.

Sowing on the "dapog" method requires 1.3 to 2.6 gallons of seed more per acre than on the ordinary method. The seed, put into a coarse canvas bag, is immersed in water (preferably slow moving water) for 24 to 36 hours, then spread out in the shade. 36 hours later, or when at least 75 % of the grains show signs of germination, the seed is put down in a seed plot prepared as follows :

The seed plot area, after irrigation, drying, ploughing and harrowing, is harrowed again on the day of sowing. When the soil is levelled and the silt settled, the water is run off, the soil is covered with whole banana

leaves, cut along the midrib, and placed so that the latter forms a borderr ight round. Care must be taken to fill all vacant spaces with leaves with their midrib excised. It is still better to build up with two or three layers of leaves a bed of a width of about a yard and a length nearly equal to that of the ricefield dyke. On the leaves a layer of 2 to 2 ½ cms. of rice husk or finely chopped rice straw is placed, and on it the germinated rice is sown very closely. 16 ½ gallons of seed suffice for sowing 2 beds 16 yds. in length by 3 ft 3ins. in width each.

The afternoon is preferable for sowing, and it is advisable to strew carefully over the seed the mud lying around the seed plot. It is generally necessary to protect the plot against excessive heat by placing at a height of 11 to 16 inches above it light shelters made up of banana leaves spread over a bamboo and board framework. During the first few days after sowing the plot is watered several times a day. In the work of the writer the use of ordinary garden watering cans was found very practical. Later on, when the seedlings are no longer liable to be carried away by the water, they should be irrigated with slow running water until the time of transplanting, because stagnant water might, during a day of great heat, seriously injure the young plants. Care will be taken of course not to submerge them, and never to leave them dry. The roots, being unable to pass through the banana leaves, grow laterally rather than vertically, and interlace with each other, forming a carpet easily separated from the sort of matting placed below. At transplanting, the interlaced roots are cut into strips of a length such as can be kept spread over the arms and shoulders or both the young plant roots and the banana-leaf matting are cut into strips. They are rolled up slowly with the banana-leaf outside and unrolled on reaching the field.

Here the root matting is cut up into fragments of about the size of a small plate, which are distributed over the rice field at regular intervals, as is done with the small bundles of young plants in the ordinary method of transplanting. In carrying out their work the transplanters hold the fragment of root matting in their left hand, keeping it spread over the palm by means of the thumb of the same hand. With the first 3 fingers of the right hand, they detach a tuft of several plants and plant it in the mud. The young plants are ready for transplanting 10 to 14 days after sowing. Experience proved to the writer that if the plants are healthy and transplanting is skilfully done, 3 or 4 per bundle, at the ordinary distance of 4 or 6 in. square, are sufficient to ensure regular growth and a maximum crop, under ordinary conditions. Generally, however, transplanting is done much more densely. The young plants, if transplanted more than 11 days after sowing, are greatly weakened and many die. If they have grown with exceptional vigour, they must be topped before transplanting. The seed plot is planted like the rest of the field after taking away or turning in the banana leaves. The rice-field is harrowed and covered with silt for the last time on the day of transplanting or partly the day before.

By the " dapog " method the yield obtained is higher than by direct sowing. Under labour conditions in the Philippines the value of the sur-

plus exceeds the increased cost of production due to transplanting. The " dapog " method is thus making its way into localities where it was quite unknown even lately. It is applicable not only to the second crop rice, but also to the regular crop of early irrigated rice.

750 - **Early Weeding of Rice Fields.** — NOVELLI N., in *Giornale di Agricoltura della Domenica*, Year XXVI, No. 19, p. 154. Piacenza, May, 7, 1916.

In cases of shortage of labour at the time when rice fields are usually weeded it is advised that this should be done with all available labour as early as possible *i. e.* directly the rice has germinated. Early cleaning is of special advantage in new rice fields, particularly cleared meadow land. In these rice fields various meadow plants continue to grow long after flooding. The practice is also of advantage in old rice fields which, shortly after flooding, are overrun by the weeds called " erba grossa " (*Ranunculaceae, Alisma Plantago, Glyceria fluitans, Cyperus* spp., etc.). Early cleaning will destroy these different weeds more readily and effectively, so that the next time it is done there will be nothing to remove but *Panicum Crusgalli* and reeds (*Cyperus* spp.). The treading down of the recently ploughed soil during the cutting back is rather advantageous than injurious through the ensuing consolidation of the soil.

Early weeding has been adopted for several years by the brothers SANCIO, who have found that it promotes and improves the growth of the rice while reducing the total cost of the work of cleaning.

751 - **Experiments in Manuring Rice with Burnt Paddy Husk, in Burmah.** — THOMPSTONE E. and SAWYER A. M., in Department of Agriculture, Burma, Report of the Mandalay Agricultural Station for the year 1914-1915, pp. 10-12. Rangoon, 1916.

The rice field used for these trials was divided into 4 plots, 2 being test or control plots, while the other 2 were, for 5 years running, manured with burnt rice husk in the proportion of 12 000 lbs. per acre, which manuring was afterwards stopped. The appended Table sums up the results during the 7 years 1908-1909 to 1914-1915.

*Results of Manuring Rice with Burnt Husk, in lbs per acre.*
*(average of 2 plots).*

| Plots | Crop 1908-09 | Crop 1909-10 | Crop 1910-11 | Crop 1911-12 | Crop 1912-13 | Crop 1913-14 | Crop 1914-15 | 7 years average |
|---|---|---|---|---|---|---|---|---|
| *Manured :* | | | | | | | | |
| Grain. . . | 676 | 1 746 | 1 321 | 1 620.5 | 2 300 | 1 856 | 1 758.5 | 1 611.2 |
| Straw. . . | 2 300 | 1 998 | 1 348 | 1 719 | 2 603 | 2 345 | 925 | 1 891.1 |
| *Unmanured :* | | | | | | | | |
| Grain. . . | 950 | 2 005 | 1 412 | 1 112 | 1 386.5 | 1 771.5 | 1 273 | 1 330.1 |
| Straw. . . | 2 562 | 3 569 | 1 715 | 1 533 | 1 429 | 1 141 | 805 | 1 822 |

In the first year of dressing with burnt husk there was a falling off in the yield, probably due to the fact that the late application had not allowed the burnt husk to mix thoroughly with the soil. In the second year there was an improvement. In the third, fourth and fifth years a yield of 30,50 and 64 % above that of the control plots was obtained respectively. Even allowing for experimental errors, there is still sufficient margin to demonstrate the beneficial effect of the dressing with burnt husk, which was due probably to the physical improvement of the soil, which was of a clayey nature, compact and impermeable. The after-effect of this dressing during the 2 years (1913-1914 and 1914-1915) when it was suspended was manifested by an excess yield of 58 % and 38 % respectively; this decline, however seems to suggest that the effect produced tends gradually to disappear.

The experiment will be continued.

FORAGE CROPS, MEADOWS AND PASTURES

752 – **Accumulated Fertility in Grass-land in Consequence of Phosphatic Manuring.** — SOMERVILLE W. (Professor of Rural Economy in the University of Oxford), in *The Journal of the Board of Agriculture*, Vol. XXII, No. 12, pp. 1201-1209. London, March 1916.

This new contribution of the writer to the manuring question brings out clearly the importance of the accumulated fertility resulting from continued dressing of permanent grass-land with slag. The greater production of meat, milk and stable manure obtained by means of these fertilisers in consequence of the increase in forage production only represents a part of the benefit provided by such fertilisation, because, side by side with the greater production of forage, an increased fertility is observed in the soil, which is probably proportional to the increased production, and is a beneficial effect of manuring grass-land with slag which has hitherto not been sufficiently appreciated.

The experiments carried out show that this accumulation of fertility is in proportion to the quantity of slag applied, the period during which the fertiliser exerted its action and the response of the soil to such fertiliser.

As a result of the use of this accumulated fertility there were obtained at Cockle Park, in 1914-1915, 70 per cent increases in wheat crops, and the 5th mustard crop (1915) showed no sign of exhaustion of this fertility. At Denton Hill and Arncot, where the grass land had been dressed with less slag and for a shorter time, the increased production due to the accumulated fertility was less notable; nevertheless it averaged 27 per cent for the 5 lands considered.

In view of the possibility of a larger extension of the tillage area in England, the writer points to the importance of this excellent slag manure for natural grass land, as the farmers who have abundantly manured their grass lands will be the first to benefit by this stored up fertility. As regards superphosphate the Author is of opinion that even if it could do no more than accomplish a 10 per cent increase in 2 tillage crops, this would be sufficient in many cases to pay the original cost of the treatment.

753 – **Chemical Determination of the Fibre Yield of Flax for the Purpose of Studying the Influence of Different Cultivation Factors on such Yield.** — LINNIK, JA., in *Сельское Хозяйство и Лѣсоводство* (Agriculture and Sylviculture), pp. 224-246. Petrograd, February 1916. FIBRE CROPS

The writer, after reviewing the different methods of steeping flax, describes the chemical method devised by him in the laboratory of technological chemistry for textiles in the Technological Institute of Petrograd. He considers it preferable to all others, as it enables the investigation of the yield of fibre to be conducted under perfectly equal conditions dependent only on the will of the investigator. In other words this method affords the possibility of obtaining comparative data for studying the influence of the different factors, for instance, manuring, on the fibre yield.

The method consists in treating the flax stalks with solutions of sulphuric acid and alkalies in an apparatus specially designed for experiments in the treatment of textile materials with chemical reagents. This treatment is carried out in a special boiler fitted with a feed heater and a centrifugal pump ensuring continuous circulation of the liquid. After careful washing in water, the wet stalks are put through the press and afterwards dried in a current of air heated to a temperature not exceeding 40° C.; they are kept for three days in this environment with constant humidity and temperature after which they are broken and combed. The flax stalks were chosen in three different places and three different groups of them were formed. The results of the analysis, with reference to the percentages of weight lost by the stalks after the chemical treatment, and the percentage of fibre yield, are as follows:

| Manure | Percentage of loss by weight of the flax stalks | | | Average percentage of loss by weight | Number of plots | Percentage of yeld in textile fibre | | | Average percentage of yield in textile fibre |
|---|---|---|---|---|---|---|---|---|---|
| | 1st group | 2nd group | 3rd group | | | 1st group | 2nd group | 3rd group | |
| Nil | 15.19 | 15.57 | 16.47 | 15.75 | 11 | 41.6 | 32.8 | 38.9 | 37.8 |
| Nitrogen | — | 13.71 | 16.31 | 15.01 | 2 | — | 35.5 | 37.5 | 36.5 |
| Potash | — | 17.12 | 17.21 | 17.17 | 2 | — | 32.4 | 35.5 | 33.9 |
| Phosphoric Acid | — | 18.52 | 16.71 | 17.62 | 2 | — | 30.0 | 36.6 | 33.3 |
| Nitrogen and phosph. acid | 17.04 | 13.89 | 15.92 | 15.62 | 3 | 39.5 | 39.0 | 35.6 | 38,0 |
| Nitrogen and phosph. acid | 16.10 | 15.35 | 17.39 | 16.61 | 3 | 41.3 | 34.6 | 36.9 | 37.6 |
| Potash and phosphor. acid | 17.27 | 16.13 | 16.14 | 16.51 | 3 | 37.1 | 33.9 | 34.9 | 35.3 |
| Nitr., potash and phos. acid | 14.38 | 17.21 | 17.47 | 16.35 | 3 | 41.1 | 31.2 | 34.9 | 35.7 |

On comparing the data in respect of loss of weight of the stalks with those of the average fibre yield, and allowing for the quality of the soil, which exerts great influence on the chemical composition of the flax stalks, the necessary guidance for selection of this plant may be obtained. The experiments carried out, however, are in the author's view only first trials,

and the chemical laboratory method of treatment of textile plants should be studied in fuller detail, being capable of a wider application and promising important economic results.

754 - **Piassava Industry of British West Africa.** — *Bulletin of the Imperial Institute*, Vol. XIII, No. 4, pp. 555-556. London, October-December 1915.

West African Piassava is a brushmaking fibre obtained from the leaf-sheaths of the wine-palm (*Raphia vinifera*). It is produced in most of the British West African possessions, but chiefly in Sierra Leone.

The exports of piassava from Sierra Leone in 1914 were 983 tons, value £ 19 492, as compared with 839 tons, value £ 12 280 in 1913. The exports from Nigeria were 403 tons, value £ 5 117 in 1914, as compared with 228 tons, value £ 2 806 in 1913. No exports of the fibre from Gambia or the Gold Coast have been recorded in recent years. The piassava industry in the Gambia appears to be worthy of attention with a view to development. The palm grows on the banks of the river, which is navigated by ocean-going-vessels.

In the course of preparing piassava in Sierra Leone, a fibrous by-product is obtained which hitherto has not been utilised. In order to ascertain whether this material has any commercial value, a sample was forwarded recently to the Imperial Institute for examination.

It consisted of a matted mass of reddish-brown fibre, resembling coir in appearance. The material was fairly clean, the fibres were very irregular in size, strength and length; this latter varied from 1 to 3 ft., but was mostly from about 20 to 30 in. The fibre contained 9 per cent moisture; 3.4 per cent ash; 65.8 per cent cellulose. The material would be accepted on the market as a substitute for low-grade coir, and would realise about £ 6 to £ 8 per ton in London, if shipped in good dry condition in press-packed bales (March 1915).

CROPS YIELDING OILS, DYES AND TANNINS

755 - **Influence of Green Manure on the Germination of Oil Seeds.** — See No. 734 of this *Bulletin*.

756 - **Investigations in Reference to Henna.** — CORTESI F. and TOMMASI G., in *Annali della R. Stazione Chimico-Agraria Sperimentale di Roma*, Series II, Vol. VIII, pp. 75-113 Rome, 1916.

This short monograph sums up the results of botanical and chemical investigations with a view to determining the methods of cultivation, uses, adulteration and market conditions of this plant, which is of considerable economic importance for Tripoli.

I. — BOTANICAL INVESTIGATIONS. — The data and description of the plant prompt CORTESI to adopt the name of *Lawsonia inermis* L. in the wider sense rather than that of *Lawsonia alba* Lam. contained in the INDEX KEWENSIS, because it was LINNE who named the *Lawsonia* genus and although the difference between *inermis* and *spinosa* corresponds to two epochs in the age of the plant, the specific name of *L. inermis* should be kept (as KOEHNE also thinks) on grounds of priority. The plant, which is cultivated in all tropical regions, may reach a height of 23 feet. The obovate or oblong or widely lanceolate leaves are 12-67 mm in length and 5-27 mm in width.

The colour of the flowers, white in the *alba* variety, is pale sulphur and also variegated in the *miniata* variety. The leaves are the most important part used and a careful description is given, together with a series of measurements. The commercial product is formed by the dried leaves, which are rarely whole, and are greyish green or yellowish brown in colour according to the age of the product. Impurities are often mixed with these leaves, such as pieces of branches and fruits, and débris of other plants, which must be regarded as added for fraudulent purposes when found in considerable quantities.

Henna has been used from the most remote times as a dye plant by the Eastern peoples : the Arabs use it as an excellent cosmetic for different purposes and also as a medicinal plant. Its dyeing qualities are widely utilised for wool, silk and wood, and in Europe it is also esteemed as the only really harmless vegetable dye. From an analysis of several samples coming from Tripoli, the writer found that the most usual frauds and adulterations consist in the addition of fragments of fig, pomegranate, olive, palm and other leaves or wood, thoroughly ground and mixed to the powdered product.

The cultivation of henna is very extensive in the fields of Tripoli and is always irrigated. The plantlets are raised in nurseries and transplanted in the spring, being planted in parallel rows at a distance of 50 × 50 cm. No manure is applied. Irrigation is carried out every 6 days. The plantation is hoed in the spring and sometimes again in the autumn, and some weeding is done. The crop lasts about 12 years, the maximum growth being reached in the second or third year. The crop is usually taken off in February and August or September, the whole of the above-ground part of the plant being cut. The annual yield of dried leaves varies from 15 to 19 cwt per acre.

II. — Chemical Investigations. — According to Tommasi henna is one of the few plants which have escaped the vigilance of plant chemists. The appended table gives the results of direct analyses and other additional determinations :

*Results of Henna Analyses.*

| Determinations | Leaves | Branches |
|---|---|---|
| | per cent. | per cent. |
| Moisture at 100°-105° C. | 10.67 | 11.40 |
| Fat (ether extract) | 6 04 | 0.60 |
| Crude fibre | 10.51 | 22.92 |
| Nitrogenous substances | 13.25 | 6.25 |
| Ash | 8.64 | 3.28 |
| Non-nitrogenous extract (calculated) | 50.89 | 55.55 |
| | 100.00 | 100.00 |
| Reducing sugars | 14.04 | 6.14 |
| Hydrolisable sugars | 14.25 | 6.30 |
| Pentosans | 7.17 | 11.72 |
| Tannin (cortex) | 0.72 | 2.95 |
| Soluble substances (extract) | 36.39 | 15.70 |
| Ash | 3.80 | — |
| Substances soluble in acetone | 18.73 | — |
| Substances soluble in absolute alchool | 33.74 | — |

The tests of the watery extract of the plant proved that the tannic substances contribute very much to imparting the different shades to wools, mordanted or not with metallic salts, and dyed with the extract of the branches or leaves. Dye tests made with cotton, wool and silk are dealt with in a table where it is shown that the results with cotton are insignificant, while with wool and silk the pigment is fixed even without mordant. The writer extracted the pigment from the leaves in the form of fine tufts of orange-yellow needles in a quantity of 2 grams per kilogram of dried henna; this pigment behaves like an acid dyestuff.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL CROPS

757 – **Production of Medicinal Plants in Italy.** — CORTESI FABRIZIO in *Natura, Rivista di Scienze naturali*, Vol VII, pp. 1-44. Milan, January-April 1916.

General considerations on the conditions of the growing of and trade in medicinal plants in Italy, followed by: 1) a list of medicinal plants (78) found wild in the Italian flora, and a synoptic table of their geographical distribution in Italy; 2) a list of the average prices quoted on the principal Italian markets for the chief medicinal drugs before and during the European war; 3) a table of Italian imports and exports of the principal medicinal drugs during the years 1912 to 1914.

The Italian flora is very rich in wild medicinal plants, but the trade in these is far from being as considerable as it should be, $^{9}/_{10}$ of it being in the hands of ignorant herbalists. Italy produces and exports (whole or in parts) the following medicinal plants:

Absinthe, aconite, adonis, agaric, almond, angelica, common aniseed, arnica, burdock, belladonna, borage, field camomile, Roman camomile, maidenhair, centaury, chicory, couch-grass, hemlock, colchicum, cumin, digitalis, hellebore, eucalyptus, eupatory, male fern, fennel, gentian, pomegranate, juniper, germander (officinal), hops, hyssop, iris, master-wort (root), henbane, laurel, cherry-laurel (leaves), lavender, lichen, flax (seed) mallow, woody nightshade, lily of the valley, manna, bugleweed, melissa (balm), mustard (seed), mint, perforated St. John's-wort, myrtle, walnut (leaves), poppy (heads), herb patience, parietary, daudelion, plantain, phellandrium, pulicaria (seeds), bear-berry, liquorice, castor oil plant, rosemary, sweet-rush, soapwort, sage, squill, spurred rye, stavesacre, thorn-apple, elder, lime tree, thyme, marsh clover, saffron, coltsfoot, valerian, violet.

Some of these plants, such as mallow, field camomile, castor oil, etc., although partly exported also need to be imported, the production being insufficient to meet the demands of national industry.

In Italy, the production of essential oils is at present confined to Sicily and Calabria, with regard to citrus oils, and to Piedmont for peppermint oils. In 1914 Italy exported: essential oils of citrus fruits, 74 558 cwt of a value of £ 484 326 (as against 92 776 cwt value £ 603 822 in 1913); spirit of peppermint: 23 521 cwt value £ 23422 (as against 43 885 cwt value £ 43 698 in 1913). The Italian spirit of peppermint is of absolute purity.

Trials of aloes cultivation (*Aloe vulgaris* Lamk.) have been undertaken in Sicily, and a juice fairly rich in active principles appears to have been obtained from the leaves. Sicily possesses almost a monopoly of the pro-

duction of manna (1), which it exports to all parts of the world. Tuscany and the province of Verona produce the best qualities of iris (*Iris florentina* L., *I. germanica* L., and *I. pallida* Lamk.). Some time ago, *i. e.* before the appearance on the market of Russian liquorice (probably *Glycyrrhiza uralensis* Fisch.) and liquorice juice prepared in a factory near Tiflis, the most important liquorice-growing countries (*G. glabra* L. and *G. echinata* L.) were Italy and Spain. The Italian liquorice plant is chiefly used for the extraction of the liquorice juice, which is exported throughout the world.

Many plants rich in alkaloids and glucosides find suitable conditions for their growth in Italy; these are principally belladonna, henbane, stramonium aconite and digitalis. The Italian belladonna, especially that of the Abruzzi, is excellent, but its production is not sufficient for home consumption; the same applies to henbane and stramonium. In Brianza, at Brunate, Civiglio and their environs (province of Como), there are fields where digitalis is chiefly grown for pharmaceutical purposes. In Sardinia, chiefly in the forests of Ortobene, beyond Nuoro (province of Sassari), large quantities are found wild, but are rarely harvested. Cultivation of the opium poppy (*Papaver somniferum* L. var. *album*) has long been carried on successfully in Sicily. The castor oil plant is extensively grown in Italy, especially in Venetia, but a considerable quantity of seeds of this plant is imported. In 1914 such imports amounted to 191 127 cwt worth £ 120 401 (as against 217 581 cwt worth £ 139 192 in 1913). The exportation of castor oil was 4954 cwt worth £ 12 949 in 1914 (against 10 442 cwt worth £ 19 520 in 1913).

As regards saffron (*Crocus sativus* L.), Italy exports it to the value of about £ 8 000 per year, but imports from Spain 80 to 90 cwt per year of a value of about £ 20 000. The competition of Spanish saffron with that of Aquila was greatly assisted by the standard packing in small sacks of 4.4 lbs. leadsealed and guaranteed, which contain the pure stigmas.

Finally, the Author advises that in addition to trials of aloes and opium poppy cultivation in Italy, the growing of Spanish camomile, hydrastis and camphor should be begun.

758 – **Bridge Grafting of Fruit Trees.** — FLETCHER W. F., in *U. S. Department of Agriculture, Farmers' Bulletin* No. 710, 8 pp., 7 fig. Washington D. C., February 21, 1916. FRUIT GROWING

For the treatment of trees that have been girdled round the base of the trunk by injuries due to quadrupeds, parasitic insects, or mechanical agents, the writer advices " bridge grafting ", made by using scions or small limbs to connect the two portions of the bark of a stock which have been separated by injury, the ends of the scions uniting with the uninjured parts above and below the wounds. The accompanying illustrations indicate the way in which the combinations of these scions form bridges of bark over the previously exposed part of the wood, the plant consequently continuing a healthy life.

When the girdle of bark removed from the trunk is too wide to permit of the above grafting, young plants of the same species are transplanted

(1) See *B.* June 1915, No. 612. (*Ed.*)

round the base of the tree. All their branches are cut away and the top of their trunk is grafted into the trunk of the tree below the upper edge of the wound. The old tree is thus provided with a new root system which enables it to survive.

759 – **The Fruiting of Trees in Consecutive Seasons.** — DUKE OF BEDFORD and PICKERING S. U. *Fifteenth Report of the Woburn Experimental Fruit Farm*, pp. 1-19. London, 1916

The view that fruit trees tend to bear heavily and lightly in alternate seasons is often made the basis of a recommendation to thin a heavy crop borne one year, in order to obtain a better crop the succeeding year. It appears, however, that the tendency towards alternate cropping, as it may be called, is very feeble, and that there is at the same time an equally potent tendency towards consecutive cropping, that is, that a tree bearing particularly well or badly during one season, will probably do the same in the succeeding season, whilst the chief factor in determining good or poor bearing is undoubtedly the atmospheric conditions, and not any innate tendency of the individual tree to either alternate or consecutive fruiting. The existence of a tendency towards alternate bearing is indicated by the fact that young trees, if prevented for four years from bearing after they have come to the age for so doing, will bear exceptionally heavy crops as soon as they are allowed to bear. But it was only in one series of experiments on some 300 young apple and pear trees during the seasons 1899 to 1903, that such a tendency was actually recognised. Observations on the same trees, made when they were younger, during 1894 to 1897 showed that their tendency then was towards consecutive bearing, and in another case of apple trees where the observations apply to over 5 700 instances, extending from 1904 to 1915, the tendency has been, with only one slight exception, towards consecutive bearing But this tendency affects the results to only a slight extent, about 12 per cent, the remaining 88 per cent being attributable to peculiarities of the season, and not to the individual behaviour of the trees. It is noticeable that the preponderating influence of external conditions becomes more marked as the tree is left more to its natural habits, *i. e.*, as it is less pruned, and, also as the age of the tree increases ; and it is more marked in the case of trees on the paradise stock than in these on the crab stock, this being doubtless a consequence of the latter coming less rapidly to full maturity than the former.

If, in a plantation consisting of a large number of individual trees whether of the same or of different varieties, it is found that good and bad fruiting seasons alternate with each other, it is evident that such alternation must be caused by some conditions affecting all the trees alike and not to any tendency to alternate bearing exhibited by the individual trees for such a tendency, if it existed, would be exhibited by different trees in different seasons, and the effect of it would be to bring about uniform production in the plantation as a whole. The alternation of good and bad years has been uniformly exhibited to a most marked extent in some plantations available for observation over a period of 20 years. As the

injury to these crops has nearly always been due to spring frosts, it is evident that the alternation of good and bad years is due to the tendency of such frosts to occur alternately in consecutive seasons.

760 – **New or Noteworthy Tropical Fruits in the Philippines.** — WESTER P. J., in *The Philippine Agricultural Review*, Vol. VIII, No. 2, pp. 103-114, plates VI-IX. Manila, 1915.

It is pointed out that many tropical fruits might be grown much more widely than they are now, and attention is called to the following species, little known comparatively in the eastern hemisphere, or even in the Far East, except in the Philippines, and some of them quite new to fruit growers :

*Antidesma Bunius* Spreng. (" Bignay "). A member of the Euphorbiaceae, a native of Malaya common to the Philippines.

*Dillenia philippinensis* Rolfe (" Catmon "). Fam. Dilleniaceae, native and common in the greater part of the Philippines,but rarely cultivated elsewhere. The fruits, which are too sour to be eaten raw, are excellent when cooked.

*Lansium domesticum* Jack. (" Lansone "). Fam. Meliaceae, very much cultivated in the Philippines for the Manila market.

*Eugenia Curranii* Robinson (" Lipoti "). Fam. Myrtaceae, very probably native to the Philippines, rarely cultivated. Its fruit, too sour for eating raw, forms an excellent jelly.

*Diospyros discolor* Wild. (" Maholo "). Might be beneficially crossed with kaki, the fruit of which would give its aroma to the hybrid. The " maholo " would provide the plant with the means of adaptation to tropical climates.

*Garcinia Mangostana* L. (" Mangosteen ").

*Arctocarpus odoratissima* Blanco (" Marang ") and *A. elastica* Reinw. (" Gomihan ").

*Sandoricum Koetjape* (Burm.) Merr. (" Santol "). Fam Meliaceae, native to Malaya yielding one of the best known fruits in the Philippines.

*Garcinia dulcis* Kurz. (" Baniti "). Fam. Guttiferae. This plant is only found wild in the Philippines. The fruit is of fine appearance and the pulp free from fibre. It is too sour and too lacking in sugar to be eaten raw, but forms an excellent preserve. Its composition is as follows :

| | | | |
|---|---|---|---|
| Water | 84.42 % | Invert sugar | 2.64 % |
| Insoluble matter | 6.78 | Acidity (citric acid) | 3.61 |
| Protein (N × 6.25) | 0.82 | Ash | 1.73 |

*Canarium ovatum*, Engl. (" Pili "). This member of the Burseraceae grows wild in some parts of the Philippines. It is not cultivated. Its nuts are very widely used. There is a form with long nuts (55 to 70 mm. and more), and another with shorter ones (45 to 60 mm). The chemical composition of their kernels is identical, as shown by the following Table.

*Percentage Composition of the Kernels of the " Pili " Nut.*

| | Long Nuts | Short Nuts |
|---|---|---|
| Water | 2.79 % | 2.9 % |
| Fat | 74.37 | 72.53 |
| Protein (N × 6.25) | 12.06 | 11.88 |
| Sucrose | 0.88 | 0.66 |
| Reducing sugars | 0.45 | 1.35 |
| Starch (by difference) | 4.33 | 5.11 |
| Crude fibre | 2.15 | 2.42 |
| Ash | 2.97 | 3.15 |

761 - **The Brazilian Pitanga (*Eugenia uniflora L.*), an excellent Fruit Tree.** — SHAMEL A. D. and POPENCE WILSON, in *The Journal of Heredity*, Vol. VII, No. 4, pp. 179-185, 2 fig. Washington, D. C., April 1916.

During their stay in the State of Bahia (Brazil), the writers frequently observed the " pitanga " in the regions occupied by citrus plantations. The " pitanga " cultivated as a tree (sometimes reaching a height of 33 to 39 feet), bush or hedge, yields a fruit resembling the cherry, but deeply lobed and with a much more distinct flavour.

The " pitanga " is native to Brazil, where it occurs widely. In the States of Rio de Janeiro, Parana, Santa Catharina and Rio Grande do Sul, it occurs wild along streams and on the skirts of the forests. It is also cultivated in other States. The Portuguese long since imported it from Brazil to Goa. Outside Brazil its cultivation is very limited. It is met with in the following countries and localities : Botanical Garden of Saharanpur (British India), Ceylon, Hawai, Algiers (where it is known as " Cayenne cherry " or " square cherry "), Cuba, Florida and California. In the two last countries, where the " pitanga " fruit is known as the " Surinam Cherry ", it is little grown, but thrives wonderfully. The cultivation of the " pitanga " therefore appears to be possible wherever citrus trees thrive, and is capable and deserving of great extension.

Reproduction of the plant is by seed. The seedlings show much less variation than those of several long cultivated fruit trees. There being several different forms and marked varieties in each tree, the species should be greatly improved by selection.

The " pitanga " suffers greatly from frosts, but it has withstood temperatures of about — 2.0° to — 2.6° C. Although originating from a moist region, it is resistant to drought and prefers light, sandy, loamy or limestone soils.

The seeds germinate well if sown fresh. It is advisable to sow them in loose earth in pots inserted deep in a hot bed, replanting when the seedlings are about 4 in. high in pots in a warm bed, and to water frequently during the winter. Plants permanently planted out require no further special care.

The shortness of the period between flowering and ripening of the fruit should be noted : it is 3 weeks in Brazil, and 5 or 6 weeks in Florida. In Brazil the plants flower in September and yield a small crop in October. They again blossom for the principal crop in December or January. In

Florida the principal crop is gathered in March, with some late fruit up till May or June. Sometimes there is a second crop at midsummer. In California the crop is gathered in September or October.

Both in Brazil and Florida fructification is abundant and very regular when once the plants have attained a sufficient age, as they require several years to reach full bearing.

The Table shows the composition of the " pitanga " fruit cultivated at Hawaii :

| | |
|---|---|
| Water | 90.7 % |
| Dry matter | 9.3 |
| Dry matter insoluble in water | 1.93 |
| Acids | 1.44 |
| Protein | 1.02 |
| Total sugars | 6.06 |
| Fat | 0.60 |

The fruits are eaten raw, or made into jellies, sherbet, liqueurs, syrups and wines regarded as medicinal (aperient and digestive). The leaves are widely used at Bahia for ornamental purposes.

762 – **Hybrid Direct Bearers in the Regions of Côtes du Rhône, France, in 1915.** — VINE GROWING.
DESMOULINS A. and VILLARD V. in *Le Progrès agricole et viticole*, 33rd Year, No. 10, pp. 228-234; No. 11, pp. 258-260; No. 12, pp. 274-279; No. 13, pp. 306-311. Montpellier, March 5, 12, 19 and 26, 1916.

The observations made in 1915 (16th year consecutive observations) (1) are of peculiar importance, because of the exceptional virulence developed by mildew throughout almost the whole of the French vineyards. The different *Vinifera* suffered very badly.

The collection forming the basis of the writers' observations, and which is increased year by year with the principal new products, is located in the valley of the Rhône, on essentially gravelly Alpine alluvial soil, without any limestone and containing numerous rounded pebbles. This soil, with medium fertility, is highly sensitive to drought and combines very favourable conditions for ascertaining the real value of the hybrids under observation, as those with poor phylloxera-resisting powers suffer speedy deterioration. All the varieties observed are free stocks.

Two tables sum up the numerical results of the observations made in 1915. The first gives, for each variety observed, the age, colour of grapes, time of ripening, resistance of foliage and grape bunches to mildew, vigour, fertility, size of bunch, compactness of bunch, size of grapes, cultural particulars etc. The second table indicates the following, in respect to the different varieties the must of which has been analysed (62 analyses altogether): average weight of bunches, general health, bunches, day of harvesting, density of must, corresponding degree of alcohol, acidity of must.

A description is given of the hybrids which yielded the best results,

(1) For the observations in 1914, see *B.* 1915, No. 1301. (*Ed.*)

and the direct bearing hybrids are then classified as follows from different points of view:

I. — CLASSIFICATION OF THE HYBRIDS ACCORDING TO THEIR RESISTANCE TO MILDEW IN 1915 :

A) *Hybrids capable of dispensing with all spraying in normal years, but which may receive one application to advantage, though such is not indispensable in wet years:* Couderc 7120 (the collection of which under observation dispensed entirely with spraying even in 1910 and 1915), 132-11, 142-26, 162-5, 162-97 — Seibel 438, 793, 867, 4995.

B) *Hybrids which may be left unsprayed in normal years without damage, though always receiving one application with benefit after flowering, and which in wet years require 2 applications for complete preservation:* Berthille Seyve 450, 618, 822, 872, 1129 — Caille 16 — Chevallier 3401 — Castel 120, 315, 1028, 6239, 19422 — Couderc Baronne 2, 503, 28-112, 106-38, 106-46, 106-51, 162-46, 171-56, 202-75, 226-58, 235-120, 272-60, 286-68, 299-35, 337-50 — Jurie 102 — Malègue 829-6 — Maureau 2 — Péage 1-18 — Perbos N° 1-46 and N° 6-53 — Seibel 1,73, 82, 84, 128, 138, 209, 844, 858, 880, 1000, 1077, 2006, 2007, 2052, 2658, 2660, 2666, 2709, 2806, 2821, 2859, 4109, 4121, 4132, 4271, 4499, 4589, 4595, 4596, 4614, 4628, 4629, 4633, 4638, 4643, 4645, 4648, 4656, 4657, 4667, 4669, 4677, 4681, 4683, 4696, 4702, 4707, 4709, 4718, 4720, 4725, 4737, 4748, 4762, 4768, 4782, 4852, 4871, 4955, 4964, 4970, 4979, 4995, 5024, 5090, 5091.

C) *Hybrids requiring 2 sprayings in normal years, one before flowering and one after ; and requiring additional application in years favourable to mildew* ; Couderc-Baronne 4, 151, 156; Gaillard 157; Malègue 474-5 ; Péage 5-10, 5-17 ; Seibel 2653, 2655, 2686, 4111, 4151, 4271, 4433, 4461, 4591, 4615, 4636, 4662, 4716, 4767, 4951, 4969, 4973, 4989, 5061.

D) *Hybrids requiring nearly as many sprayings as the Vinifera* : Malègue 469-9, Seibel 4616, 4968, 4991, 4999, 5001.

II. — CLASSIFICATION ACCORDING TO THE INTENSITY OF COLOUR OF THE MUST :

1) *Hybrids with pink or light red must* : Couderc 202-75, Seibel 1000, 2859.

2) *Hybrids with ordinary red must* : Couderc 7120, 132-11, 162-97, 363-N, Seibel 1, 4271, 4268, 4643, Malègue 829-6, Berthille-Seyve 618, 822.

3) *" Teinturier " hybrids, with dark red must :* Couderc 106-46 (demi-teinturier); Seibel 128-2007, 2660, 4499 ; Berthille-Seyve 872-1129.

III. — CLASSIFICATION OF HYBRIDS ACCORDING TO THE NATURE OF THE SOIL IN WHICH THEY SEEM TO THRIVE BEST (the limestone factor is disregarded in this classification : in limestone soils grafting must be resorted to for hybrids not possessing sufficient resistance to chlorosis) :

A) Dry Soils. — Can be planted out freely :

1) *1st period black grape* : Couderc 202-75, Seibel 1000, 2859, 4643, Berthille-Seyve 872, 1129.

2) *2nd period black grape* : Couderc 162-97.

3) *Black grape, end of 2nd or 3rd period of ripening* : Couderc 7120, 132-11, Berthille-Seyve 822, Seibel 4271.

4) *White grape, 1st period*: Couderc 272-60, 162-5, Berthille-Seyve 450
5) *White grape, 2nd period*: Seibel 793, 858, 867, 4633.
6) *White grape, end of 2nd or 3rd period*: Seibel 4595, 4762.

B) Medium Soils. — Can be planted and cultivated free:

1) *1st period black grape*: Those mentioned for the dry soils plus: Seibel 128, Couderc 106-46, Seibel 4499, 4628.

2) *2nd period black grape*: Couderc 162-97, Seibel 2007, 2660, Bethille Seyve 618, Malègue 829-6, Couderc 363-N.

3) *Black grape, end of 2nd or 3rd period*: Those mentioned for the dry soils.

4) *1st period white grape*: Those mentioned for the dry soils, and also: Castel 1028, Seibel 880, 4681 Gaillard 157.

5) *2nd period white grape*: Those mentioned for the dry soils, and also: Castel 13 706, Seibel 4657.

6) *White grape, from end of 2nd or 3rd period:* As for the dry soils. and also: Seibel 4595, 4762.

C) Good Soils. — Can be planted free:

1) *1st period black grape*: Seibel 128, 4199, 4628.

2) *2nd period black grape*: Seibel 1, 2007, 2660, Berthille-Seyve 618, Malègue 829-6, Couderc 363-N.

3) *Black grape, end of 2nd or 3rd period*: Couderc 7120, Berthille-Seyve 822.

4) *1st period white grape*: Castel 1028, Seibel 880, 4781, Gaillard 157, Couderc 299-35 (Muscat du Moulin).

5) *2nd period white grape*: Castel 13706.

During their observations the writers found that the quantity of grape produced increased up to the 6th year of life of the hybrid, and then remained more or less constant.

By resorting to grafting for hybrids also, their length of life is increased and the range of adaptivity and utilisation of the different varieties of hybrids is very much extended. The question, however, of affinity of the direct bearing hybrids with the principal grafting hosts is not very well known as yet. Save for a few exceptions, hybrids are generally good scions, especially for hosts of *Vinifera* strain (Franco-American), especially on the various *Rupestris* × *Vinifera*.

763 - **Observations on Direct Bearers at the Royal Oenological School of Conegliano, Italy.** — Dalmasso G., in *Rivista di Viticoltura, Enologia ed Agraria*, Year XXII, Series V, No. 4, pp. 57-62, No. 5, pp. 74-78, No. 6, pp. 90-92, No. 7, pp. 108-111, No. 8, pp. 127-129. Conegliano, February 15, March 1-15, April 1-15, 1916.

These observations, made during the wine season of 1915, relate to the following hybrids: Castel 120, 1028, 3917, 4233, 5009, 6011, 6030, 6606, 7214 black, 7214 white, 13317, 13320; Couderc 101, 603, 84-3, 93-5, 1305, 4308, 4401, 74-17, 82-32, 106-46, 126-20, 126-21, 132-11, 198-21, 199-88, 267-27, 28-112, 746-51, 202-137; Seibel 1, 156, 1004, 1077, 2007: Alicante Rupestris Terras No. 20; Fournié.

The following hybrids showed the best qualities: Seibel, 1, 1077; Couderc 4401, 106-46; Castel 6606. All the last named gave a fairly abundant

production, an ordinary (red) table or semi-blending wine without foxy flavour, and of good quality. They also were found to posses great resisting powers to fungoids diseases. (The locality where the experiments took place being immune from phylloxera, it was not possible to test the resistance of the hybrids to this disease).

Among the mediocre hybrids, which are at any rate still worth keeping under observation, possessing some good qualities, the writer mentions : Castel 5009, 6030, 7214, 13317, 13320 ; Couderc 603, 4308, 96-32, 267-27, 746-51, 202-137 ; Seibel 156, 2007 ; Fournié. All of them yielded a sufficient or abundant crop of mediocre or even better quality, and a wine without foxy taste. They all proved very resistant to mildew and Oidium, Even in a year as unfavourable as 1915, both these last hybrids and those mentioned above remained perfectly healthy without any treatment being applied to them.

With the exception of Couderc 746-51 which has white grapes, all the hybrids mentioned as good or mediocre have black grapes. In the entire collection there was only one white-grape hybrid which was mediocre, Couderc 746-51. In addition, it has the defect that it yields a wine not entirely free from foxy taste.

764 – **An Interesting Problem in Connection with Radial Pruning.** — DALMASSO G., in *La Rivista di Viticoltura, Enologia ed Agraria*, Year XXII, Series V, No. 10, pp. 156-159. Conegliano, May 15, 1916.

Radial pruning has elicited interesting discussions as to the method of its application, and the question whether on each rod (" cordon ") small

TABLE I. — *Riesling Italico (hill).*

| Year | Production per vine Kg. | | Sugar in must | | Acidity of must | | Ripening index | |
|---|---|---|---|---|---|---|---|---|
| | Small arcs shorter at base | Small arcs longer at base | Small arcs longer at base | Small arcs shorter at base | Small arcs longer at base | Small arcs shorter at base | Small arcs longer at base | Small arcs shorter at base |
| 1911 . . . . | 4.35 | 3.46 | 19.30 | 19.65 | — | — | — | — |
| 1912 . . . . | 4.40 | 3.60 | 19.70 | 18.60 | — | — | — | — |
| 1913 . . . . | 5.95 | 4.66 | 20.40 | 19.75 | 9.80 | 9.75 | 2.08 | 2.02 |
| 1914 . . . . | 3.93 | 2.94 | 21.35 | 22.20 | 7.12 | 6.74 | 3.00 | 3.28 |
| 1915 . . . . | 2.37 | 3.05 | 22.30 | 6.56 | 6.56 | 6.18 | 3.40 | 3.83 |
| Averages | 4.20 | 3.54 | 20.61 | 20.78 | 7.83 | 7,56 | 2.83 | 3.04 |

TABLE II. — *Cabernet franc (hill).*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1911 . . . . | 7.222 | 5.410 | 19.00 | 18.40 | — | — | — | — |
| 1912 . . . . | 2.722 | 2.058 | 21.50 | 21.80 | — | — | — | — |
| 1913 . . . . | 5.000 | 2.850 | 20.53 | 20.28 | 9.25 | 9.25 | 2.21 | 2.19 |
| 1914 . . . . | 8.550 | 5.470 | 19.65 | 19.30 | 9.08 | 8.25 | 2.16 | 2.34 |
| 1915 . . . . | 5.830 | 4.600 | 21.40 | 20.05 | 7.87 | 6.90 | 2.72 | 2.99 |
| Averages | 5.865 | 4.077 | 20.41 | 19.96 | 8.70 | 8.13 | 2.36 | 2.47 |

fruit-setting arcs of uniform length should be left or whether they should be longer at the base or at the end of the section, has not yet been solved. The Author, after reporting the different opinions of TRENTIN, SANNINO and STRADAJOLI, sets out the results of the trials carried out for the last 5 years at the Wine School of Conegliano, in two vineyards situated in the upper part of the farm of that school. It is obvious from the two following tables, that for horizontal or slightly oblique radii it is advisable to leave the arcs at the base longer. The production per unit shows a marked advantage on the part of the arcs longer at the base, and this quantitative difference more than makes up for the slight detriment to quality.

765 – **Program for the Triennal Period 1915-17 arranged by the Swedish State Institute of Experimental Forestry** (Av styrelsen för Statens Skogsförsöksanstalt for treårsperioden 1915-1917 fastställt arbetsprogram). — *Meddelanden från Statens Skogsförsöksanstalt*, Part 12, 1915, pp. 58-60. Stockholm, 1916. FORESTRY

Following a meeting of the members of the governing Council and the professors of the Swedish High School of Forestry and of the Institute of Experimental Forestry, together with three specially summoned experts, the program of work to be followed at the Institute of Experimental Forestry has been sanctioned, with the right for the Institute to carry out minor investigations not laid down (1).

I. — THE QUESTION OF REGENERATION.

*a*) Seed investigations.

Investigations shall be begun for the discovery of the most suitable time for gathering cones and as regards the keeping of forest seeds (Forest Section). The biology of germination of the most important forest trees shall be studied, with special attention to the conditions of germination offered by the soil (Physical Section). The experimental plots for the investigation of the percentage of soil germination of the Norrland pine-seed shall be revised and the results prepared for publication (Forest Section). Existing areas for testing seeds of various origins shall be revised when so required (Forest Section).

*b*) Special measures for securing natural regeneration.

In suitable places experiments by means of thinning in accordance with WAGNER's method shall be carried out (Forest Section), and in connection herewith the seed-producing capacity of forest margins of different composition shall be studied (Forest Section). The degree of regrowth in cleared lands shall be investigated in connection with their lie as to the points of the compass (Forest Section). The effect of brushwood burning and complete clearing of the soil shall be investigated with regard to the supply of nitrogen in the soil (Physical Section).

*c*) Measures of forest cultivation.

(1) As is prescribed in § 15 of the new Royal Instructions for the State Institute of Experimental Forestry (Cf. *Kungl. Maj.ts nådiga instruktion för Statens Skogsförsöksanstalt ; given Stockholms slott den 5 mars* 1915). *(Ed.)*

The experiments instituted for the investigation of the most suitable time for sowing in Norrland shall be continued (Forest section). Existing experimental cultures with pine and spruce in various combinations shall be revised, if need be (Forest Section). The course of growth in the roots of planted trees shall be investigated with a view to the discovery of the most suitable time for planting (Forest Section or Physical Section).

*d*) The problem of regeneration in special types of forest.

The investigations previously carried on concerning the difficulties of regeneration on the pine-heaths shall be continued so far as is necessary for the completion of a report concerning this problem (Physical Section).

II. — Proceedings as regards the composition of forests.

*a*) Slight and extensive thinning operations.

Existing areas for slight and extensive thinning shall be revised if necessary, and new areas shall be arranged so far as time permits, chiefly in pine forests and spruce forests of low productivity and in spruce forests in Norrland of all grades of productivity, in the birch forests of Norrland, in certain forests composed of aspen and oak, and in mixed coniferous forests (Forest Section). In the last named mixed forests there shall be arranged areas of young seedlands or plantations in order to throw light upon the best way of raising forests of mixed composition (Forest Section),

*b*) Alteration of ground flora.

In some of the more suitable experimental areas for heavy thinning the ground vegetation shall be investigated in accordance with the Raunkiaer method, as modified by Lagerberg, in order to obtain fixed points for estimating the effect of the most thorough thinning upon the ground vegetation (Physical Section).

III. — Diseases and injuries of forest trees.

*a*) Diseases and injuries caused by fungi.

The occurrence and spread of the roots in the spruces whose tops were broken off during the winter of 1910-11 shall be examined (Physical Section). Moreover the roots of coniferous trees shall be taken up for closer investigation, with special attention to the conditions in the over-aged forests in Norrland (Physical Section).

*b*) Injuries caused by insects.

Investigations shall be instituted as regards injurious insects both in spruce cones and pine cones and in forest plants in nurseries. The extent of the increased ravages of bark beetles in certain districts shall be studied; and at the same time knowledge of the known methods of effectively dealing with these last named insects should be spread amongst forests owners. In addition to this, should other insect ravages take place, studies should be instituted and advice given as to the checking of their ravages (Entomological Section).

IV. — Races of forest trees and the serviceableness of foreign forest trees to Sweden.

*a*) Race studies of spruce and pine.

Previous plantations of plants raised from selected seed shall be looked after so far as is necessary (Physical Section).

*b*) German spruce seed.

Existing stocks of plants of German spruce shall be used for the laying out of experimental areas, and the stock of plants shall be handed over to the superintendent of forest-districts (" revirs ") with the request that they may be used in the forest cultures of the district (Forest Section).

*c*) Larch.

Further areas shall be laid out in larches, after which the results of the investigation into this kind of tree shall be prepared for publication (Forest Section).

V. — Investigations concerning forest land.

*a*) Types of soil.

With a view to effecting a systematic survey of the different types of forest land in Sweden an investigation of the most important types shall be begun, in which attention shall be directed both to the genesis of the types and to their value from the standpoint of forestal productivity (Physical Section.

*b*) The genesis and improvement of degenerate forest land.

The studies of ling-heaths shall be continued in the same way as before with a view to summarizing the observations in a publication (Forest and Physical Sections).

*c*) Studies of the waterlogging of the forests in Norrland shall be continued in the same way as before and, so far as time allows, preliminary investigations shall be made concerning the waterlogging of forest land in the Southwest of Sweden (Physical Section).

*d*) The transformation of moss land to forest land.

Even if time is not available for the special investigation of this matter, yet attention should be directed to this problem when a suitable opportunity offers.

## LIVE STOCK AND BREEDING.

766 - **Injury to Livestock by *Simulium columbaczense*, in Hungary.** — Schmidt M., in Állatorvosi Lapok (Veterinary Journal), Year XXXIX, No. 12, pp. 83-85; No. 13, pp. 89-91. Budapest, March 18 and 25, 1916. HYGIENE

In Hungary, the periodical outbreaks of *Simulium columbaczense* at times occasion exceedingly grave injury to cattle. Thus, in 1783, in Banat, there died from the bite of these insects : 52 horses, 131 cattle, 310 sheep and 130 pigs. In 1813 they killed 200 cattle in the neighbourhood

of Arad and 500 in the neighbourhood of Versecz. In 1880, 400 pigs, 80 horses and 40 cattle perished within 4 hours at Kevevara, and 100 cattle, 5 horses and 8 pigs in the "comitat" of Hunyad. Finally, in April 1915, the appearance of swarms of *S. columbaczense* caused widespread damage in the "comitat" of Temes alone, with a loss of 41 horses, 404 cattle, and 320 pigs. The places where outbreaks of *Simulium* occur are enumerated, with a description of the appearance of their swarms and the behaviour of domestic animals before and after the attack. This is followed by some clinical observations on the infection due to the bite.

Where large numbers of animals have been infected, there are many difficulties in the way of treatment, and prophylactic measures alone can be adopted. The writer employed the following method:

The flies were removed from the body of the animals by rubbing the skin with a clean cloth, after which the skin was washed with camphorated spirit. The animals were given 300 to 500 grams of brandy per head, diluted in water; in severe cases this dose was repeated a few hours later. Under similar conditions, other cardiac agents are to be recommended, and likewise the administration of purgatives to cure digestive troubles. Tumours were treated at the outset with subacetate of lead, but the results being negative a mixture of soap dissolved in alcohol and spirit of camphor with a little turpentine added was employed. Thanks to repeated friction with this and constant exercise (long runs) the tumours completely disappeared.

It being impossible to overcome the disease, the only thing to be done is to protect animals individually. When the flies make their appearance the animals must be kept in the stable, or if already out to grass they must be removed from the places visited by the insects. Since, however, local conditions do not always allow of adopting this course, the flies must be driven off by burning wet branches, dung or straw, or anything which will produce a dense smoke, to which the animals instinctively draw near. For animals used for draught or other work, a protective coat of oil or other fatty substance should be applied to the skin. The application of concentrated tar is not advisable. Valuable horses should be covered with fly nets and the stables built so as to keep flies out (fly flaps on doors and windows, or fire smoking in front of entrance).

The method of communication of the disease resulting from the bites of the *Simulium*, often assuming an acute form and causing sudden death, remains unknown hitherto. Microscopical analyses of the blood of the diseased animals and the spleen of the dead ones preclude any participation of bacteria or protozoa. Test animals inoculated with extract of *Simulium* remained free, which suggests that the extract possesses no toxic properties. Again, in the body of *Simulium* no micro-organisms were found. Nevertheless, animals attacked fall seriously ill within a few minutes, and often die within half an hour, although death from asphyxia is very rare, as was proved by a post-mortem of dead or slaughtered animals. In all the animals attacked, however, the Author observes some symptoms of nervous derangement, such as diminution of sensitiveness, general torpor,

uncoordinated movements and blindness. These symptoms, as well as those of the heart (rapid palpitation) prove that *S. columbaczense* injects some toxic substance which reaches the nervous system and paralyses the nervous centres of the medulla oblongata; during this process the modification in the circulation causes tumours on the soft part of the larynx, which hinders respiration.

The Author suggests that further extensive experiments be undertaken with the blood of diseased animals, and the pathological changes of the nervous tissue, if any, be studied.

The meat of slaughtered animals is quite harmless to man. To facilitate control, herdsmen should, before the *Simulium* appear, be made acquainted with various protective means and recommended to destroy severely attacked animals before death occurs and to bleed them thoroughly.

767 – **The Possible Passage of Trypanosomes into Milk.** — LANFRANCHI ALESSANDRO, in *Atti della Reale Accademia dei Lincei*, 5th Series, *Rendiconti*, Vol. XXV, Part 5, 1st Half Year, pp. 369-373. Rome, 1916.

Work carried out at the Institute of Pathology and Clinical Medicine of the Royal University of Bologna.

Several writers have shown that a large number of trypanosomes are able to pass through the different mucous membranes, and NATTAN LARRIER has already taken in hand the solution of the problem of trypanosomes passing into milk. The result was affirmative as regards *Tr. schizotripanum* Cruzy, and almost always negative for *Tr. equiperdum*. The writer next describes his experiments with the trypanosomes *Brucei, Evansi, rodesiense* and *gambiense*.

The virus was injected into the veins of bitches which had just littered. It was desired to find: 1) whether the young when allowed to suck were infected; 2) whether the presence of trypanosomes could be detected by di ect examination of milk; 3) whether the milk when inoculated into the peritoneum was able to infect rats or mice.

From the results it is concluded that:

1) The passage of the trypanosomes *Brucei, rodesiense* and *gambiense* into milk is possible.

2) The infection with the virus of *Brucei* and *gambiense* can be transmitted by suckling.

768 – **Enquiries and Experiments in connection with the Immunity of Cattle against Epizootic Foot-and-Mouth Disease.** — TERNI CAMILLO, in *La Clinica veterinaria*, XXXIXth year, No. 9, pp. 257-261. Milan, May 15, 1916.

The results obtained in the investigations and tests carried out at the "Stazione sperimentale per le malattie infettive" of Milan, confirm those which had previously been obtained by Messrs. COSCO and AGUZZI (1) and lead to the following conclusions:

1) The virus is preserved indefinitely by means of its successive passage through animals susceptible to the disease, when blood products (se-

(1) See *B.* June 1916. N° 661. (*Ed.*)

rum and red globules) are used in the same way as with the products of local lesions. The best method for preserving its virulence and observing its infective power in those tissues where the disease arises preferentially under natural conditions, is that of *inoculating into the tongue* infective material or blood taken from the animal during a period of fever excee ding 40° C., or the product of local lesions. The maximum virulence is produced by passing through the epithelium of the digestive apparatus (tongue or paunch).

2) The virus obtained in this way, whether fixed or temporary, represents the maximum intensity of virulence both in infective and spreading power, the adult animal falling sick in 24 to 36 hours. It almost always kills young animals, especially when not yet weaned (calves, lambs, kids or sucking pigs), by general infection, the virus being constantly present in the blood.

3) The present experiments would appear to show that several kinds of animals are capable of containing in their blood for some time a very virulent virus of foot-and-mouth disease, without specific external symptoms or with merely slight lesions of the mucous membrane of the digestive apparatus or the pad of the short pastern.

4) With the blood products kept in a thermostat, or cold, until the virulence is exhausted, it is possible to create a resistance to foot-and-mouth disease in animals, which will allow of making successive inoculations of living virus, and of obtaining a much higher degree of immunity as compared with animals which have overcome the disease in a serious form (38 months of observations on a group of 20 cattle).

5) Similarly it is found that the serum of the blood of cattle which have passed beyond the febrile stage of the disease is of marked curative and preventive efficacy against even a malignant form of virus. The inoculation of the blood as such or of serum, under these conditions (containing the maximum of antibodies), is a sure preventive of the death of adult animals, and results in their speedy recovery. A therapeutic system in the cowshed or cattle-pen is therefore practically possible, if serum be taken from recently cured animals and injected into those most seriously ill. In this connection, the haemovaccination advocated by PERRONCITO also possesses an acceptable pratical basis.

6) In foot-and mouth disease, 2 forms of immunity are distinguished, one general, which is located in the blood and more particularly in the white globules (preferentially eosinophiles), the red globules and the plasma; the other of a more strictly histogenic character and involving the protective epithelia of the digestive passages. The latter is less lasting than the immunity located in the blood, and is strictly related to the wear and regeneration of the epithelial cells. In cattle, by means of *injection into the tongue*, it is found that the gradual loss of immunity begins with the *epithelium of the tongue*, followed by that of the rumen and the small intestine, and the mucous membrane of the hoof pad.

Thus, as happens under natural conditions, there may be animals presenting serious external symptoms, involving chiefly the epithelium of the

tongue, while the virus does not pass into the blood, which still retains a sufficient degree of immunity to prevent general infection, or else it enters the blood for a very short time and in an attenuated form only. These are the cases when the feverish reaction does not take place or only amounts to a few tenths of a degree for a brief period.

The clinical forms of foot and-mouth disease (external, internal or malignant) are in direct relation with the fluctuations in the degree of immunity existing in the local tissues and the blood. When the animal has never had the infection, or has completely lost the internal or local immunity produced by a previous attack of the disease, the slightest injury to the epithelium of the tongue and the rumen (for instance, injuries caused by the heads of rye-grass, in the presence of the virus) suffices to produce a first focus of the disease, which in a few hours causes the infection of the blood, marked by the onset of fever. When on the other hand, as frequently occurs, after an attack of foot-and-mouth disease, some degree of immunity still continues in the blood, the seat of disease involving one or more points of the epithelium of the entrance to the digestive passages remains localised but the virus may, in this first passage, acquire an increase of infective activity for other susceptible animals.

7) Therefore, in the production of immunity against the malignant virus of the disease, *i. e.* the one with the maximum of infecting and spreading power, the writer preferred to combine the products of local lesions with those of the blood in order to utilise the substances elaborated by the virus in the tissues for which it exhibits a preference, and obtain an enhancement of local histogenic immunity in order to secure a lasting and sure prevention of external lesions. The latter, even if slight, may have serious consequences, owing to the occurrence of secondary symptoms or the spread of the virus through the body.

In the lesions of the epithelium, substances are observed which may be termed *granulo-stimulines* and *granulo-lysines*, inasmuch as they exert, as a specific character, in the first place a positive chemiotaxy for the leucocytes with eosinophile granulations, and afterwards a lithic action, which results in an infiltration of the eosinophile granulations into the tissues of the sick animal in direct ratio to the gravity of the infection. The character of immunity is indicated by the cessation of the process of dissolution of the eosinophile cells.

8) In animals which have died from foot-and-mouth disease at a late period, the virus may also not be present in the blood, but is found localised in various organs, especially in the cardiac muscle, the brain, the liver and the kidney, less frequently in the spleen or the marrow. When the virus is in the blood it is chiefly found in the venous blood, being in largest amount and virulence in the portal vein.

The bulk of the virus is eliminated from the blood through the kidney. This elimination also occurs, though in a lesser degree, through the milk and the saliva. In the majority of cases these only become infectious owing to the products of local lesions. It can even be shown that the

action of the saliva tends to attenuate the virus, while, in the urine, its virulence is long maintained unaltered (1).

ANATOMY AND PHYSIOLOGY: GENERALITIES.

769 - **Osmotic Equilibrium between Blood and Milk in the Cow.** — VAN DER LAAN, F. H. in *Biochemische Zeitschrift*, Vol. 73, Nos. 5-6, pp. 313-325. Berlin, April 4, 1916.

The writer's previous experiments (2), in relation to osmotic concentration of the blood, milk and bile in the cow, have shown that the value of the three concentrations is the same, even if the osmotic concentration of the blood is artificially modified. These experiments, however, having all been made with healthy animals, the concentration in sick animals still remained to be studied.

It has been ascertained that in man certain diseases, chiefly those of the heart and kidneys, produce a great increase of osmotic pressure in the blood, owing to derangements of metabolism. Doctors therefore ascertain the freezing point of the blood of their patient when they wish to find out whether one of the kidneys or both are diseased.

The writer used this method for studying the osmotic concentration of the blood in 8 cows suffering from : toxemia, constipation, chronic peritonitis with acute anteritis, pyelonephritis, loss of blood through perforation of the rectum, tuberculosis (2 cases), fracture of the ileum. With this object he determined the freezing point of the blood, the milk, and in some cases the bile. The investigations showed that the freezing point of the blood and milk are not modified by the disease. In one case only the osmotic pressure of the blood was increased owing to auto-intoxication, but the osmotic pressure of the milk had undergone a corresponding increase. The Author mentions in this connection an experiment made by PLIESTERS on a cow suffering from anthrax (splenic fever), which gave a similar result.

In spite of the small number of cases observed, it is believed that the diseased condition can only increase and never reduce the depression of the freezing point of the blood of the cow. In most cases the disease will not

(1) The question dealt with here is, as it were, the crux of the problem of immunity, not only in respect to foot-and-mouth disease, but also to other infectious diseases with filterable virus located in the blood. Thus, for instance, in cow-pox just as in foot-and-mouth disease, by passage through hypersensitive animals, a virus of special infective activity to the blood can be produced. In that case cutaneous inoculation of the blood or its components separately produces the characteristic pustules even in man. By using this intensified virus a widespread eruption is easily caused in man (4 cases out of 12 inoculated), but the virulence may be reduced if the blood is kept on glass for a given period, in the presence of oxygen.

In comparative studies of cow-pox and foot-and-mouth disease, the writer found that the two viruses behave similarly as regards local and general immunity. In some cattle which had been inoculated with positive results more than 7 years since, he observed that the immunity persisted as regards cutaneous inoculation or quite temporary reactions alone were produced, while when inoculated on the mucous membrane (tongue) characteristic pustules were obtained but then the virus did not pass into the blood. If, on the other hand, young animals are used which have never been infected (preferably meadow-fed, as then less liable to contagion through human vaccination), whatever the channel of entrance, the virus passes into the blood and continues present there during the febrile period.

(2) See *B.* 1915, No. 1314.

exercise any influence on the absolute freezing point of the blood and the milk. For practical milk testing this fact is very important, as the lowering of the freezing point of milk is often justified on the ground that it comes from a diseased cow.

The osmotic pressure of the milk, and in some cases of the blood, was also studied in several cows with a diseased udder. Most of the animals had streptococcal mastitis, the mastitis being of a tuberculous nature in 2 cases only. Experiment proved that the milk was of very abnormal composition. The diseased teats regularly gave an abnormal milk quite different from the normal.

The lactose had generally disappeared, and the content of ash and chlorine corresponded to that of the blood serum. In spite of all these anomalies, however, the freezing point of the milk was always normal, except in one case where the animal was very ill owing to auto-intoxication. The blood of the cows yielding this milk had a lower freezing point than that of the blood of healthy animals, but it corresponded exactly to that of the milk. These experiments therefore show that the worst forms of mastitis cannot affect the osmotic concentration of the blood and milk in cows.

The fact that as the mastitis develops the composition of the milk resembles that of the blood serum more and more, has been explained by the hypothesis that the process of secretion is gradually replaced by one of filtration. It is a point in favour of this view that the freezing point is not modified by the disease, because the filtered product (milk) has the same freezing point as the blood of the same cow.

From the fact that mastitis does not modify the equilibrium between the osmotic concentration of the blood and that of the milk, it is inferred that milk from the diseasesd teats must have the same freezing point as from the healthy ones. Experiment proved the correctness of this view.

By another series of experiments it was demonstrated that in cases of mastitis the depression of the freezing point of milk remains unaltered so long as the disease is not followed by general intoxication increasing the osmotic concentration of the blood. This seems to contradict the results obtained by the other investigators. The writer believes that the depressions observed by several investigators in the milk from a diseased teat was due to detritus, etc, mixed with the milk in question.

The cream has the same freezing point as the corresponding skim milk.

The depressionof the freezing point, both in milk from healthy and from diseased udders, is never less than 0.53 C.

770 – **Grain Screenings and Results of Feeding Experiments in Canada.** — Dymond J. R. Archibald E. S., and Eldorf F. C., in *Dominion of Canada, Department of Agriculture*, 44 pp. 8 tables. Ottawa, 1915. FEEDS AND FEEDING

Cereal growing has rapidly increased during the past few years in the prairie region of Canada. As a result of the system of continuous cultivation, the crops contain a noteworthy proportion of foreign seed. In the year ended 31st August 1913, the Inspection Service of the Cereals Commission of the Department of Commerce recorded the presence at the central silos of more than 100 000 tons of screenings of wheat, oats, barley and lin-

seed. It is calculated that the costs of carriage of this material from the fields to the silos amounts to 650 000 dollars. It contains empty or broken seeds of wheat, oats, barley and flax, with variable proportions of a large number of weed seeds. The greater part is exported to the United States, where it is screened once more for the production of different cattle feeds.

Owing to the extreme smallness of the seeds of certain weeds, and the hardness of some others, they cannot be crushed by the ordinary grinding machinery. Special plant is required, which is expensive in cost and operation, for the purpose of thoroughly grinding all impurities. If screened again through a zinc screen with meshes of 1.8 mm so as to separate the very smallest weed seeds, which are called black screenings, crushing can very well be carried out with ordinary grinding machines, if the screening and crushing are carefully done. This gets rid of about 40 % of the ordinary screenings.

It must be remembered that feeds manufactured with screenings not properly cleaned may contain thousands of live weed seeds per pound. Feeds of this kind should not be given to cattle, as this might promote the spread of weeds to the extent of causing thousands of dollars worth of damage.

The feeding experiments carried out with cows in milk, pigs, lambs and chickens, showed that the blank screenings are valueless as a food and are also expensive owing to the adulteration which they cause. When mixed in considerable proportions with another food they render it distasteful to all livestock. Although by adding molasses to crushed screenings containing their share of black screenings the food is rendered appetising, it is not economical. In short, the cheapest way of rendering screenings palatable is to remove the black seeds.

The screenings, with their black part eliminated, may be given without restriction to horses, cattle, sheep or pigs. It is preferable, however, that they should not form more than 50 to 60 % of the total grain ration. Buckwheat screenings are particularly suited as food for poultry, but it seems dangerous to give the latter linseed screenings.

As the makers of threshing machines all claim that their machines are, or can be, fitted with screens which are able to separate a large portion of the waste in threshing, the Authors are of opinion that, if greater care were taken in separating the grain during threshing, it would not only save the cost of transport of the impurities, but the farmer would in this way be provided on the spot with a very useful feed which he could employ direct on his farm or sell to breeders. It should, however, be pointed out that weeds cause enormous losses to farmers every year, so much so that though it is desirable that everything of value as a food, such as screenings, should be turned to account, it would be preferable to burn them rather than use them in a way which might help the growth of weeds.

To sum up, from the practical point of view, the black screenings must be separated from the others and burnt, as they only reduce the nutritive value of the other screenings comprising bigger seeds. They also form a danger with regard to the spread of weeds. They have an appreciable fuel

value ; they chiefly represent seeds of *Chenopodium album* L. and Cruciferae rich in oil, which it might be profitable to burn after mixing with coal.

771 - **Spotted Asses.** — JENKS ALBERT ERNEST, in *The Journal of Heredity*, Vol. VII, No. 4, pp. 165-168, 2 figs. Washington, D. C., April 1916. HORSES ASSES AND MULES

Wild specimens of domestic breeds, and the wild species most nearly related to domestic animals, are spotted in a typical or specific way, but it is rare for these markings to be white. On the other hand, domestic and pet animals show white spots in almost all species. This white spotting, however, has rarely been reported up to the present for the Asiatic elephant (*Elephas indicus*) and the dromedary (*Camelus dromedarius*.) The writer never found it reported of the donkey in the literature of the subject. He therefore describes some cases of white spots on a grey coat or black on a white coat which he observed in the United States (Arizona) and in Italy (Naples and environs). It should be noted that the 3 species rarely spotted white, namely the elephant, the dromedary and the ass, have been much less subject to selective breeding than the majority of the other domestic species. They exhibit only a small number of breeds. This confirms the idea that hybridisation by selection is an important factor in the formation of white spots in domestic animals.

772 - **The " Miranda " Breed of Cattle (Braganza, Portugal).** — CRUZ SHEPPERD, in *Revista de Medicina Veterinaria*, 14th Year, No. 168, pp. 351-360. Lisbon, February 1916. CATTLE

The special environmental conditions of the place of origin of the Portuguese " Mirandesa " breed of cattle, namely, isolation and scarcity of forage, have imparted great purity to it, together with the characteristic of furnishing particularly fine working animals. Together with the " Brava ", " Landaise ", " Charolaise " and " Sicilian " breeds, it forms the Iberian stock, originating from *Bos primigenius*. From it there have been derived by progressive adaptation to different environments, the sub-races 1) " Braganza " ; 2) " Beira "; 3) " Mirandes estremenho " or " Ratinho serrano " which form almost the whole of the cattle stock of Estremadura ; and 4) " Jarmelo ", a breed specially noticeable for its excellent milk-producing capacity.

By improving the pasturage, it will be easy to make the " Mirandesa " breed excellent for meat and milk production, in addition to its working powers. Cattle of this breed are now being exported in large numbers to Spain, where they are fattened for slaughter. Their principal characteristics are : straight profile of head, straight medium sized horns, neck short and thick, chest wide, very high and deep, shoulders muscular, back slightly arched, rump higher than the withers, paunch regular, hips projecting, low insertion of tail, limbs long bony, often badly balanced, coat chestnut more or less dark, with a light yellow strip along the line of the back, from the withers to the base of the tail and darker in the bull than in the cow.

773 - **Feeding Cows with the Subcutaneous Matter of Skins intended for Tanning Experiments in Germany** (1). — GERLACH, in *Deutsche Landwirtschaftliche Presse*, 43rd Year, No. 26, p. 229. Berlin, March 29, 1916.

For his feeding experiments the Author used a subcutaneous material ("Leimleder", glue leather i. e. leather cuttings containing gelatinous matter), at present sold in Germany under the inappropriate name of "Bader meat meal" and containing, according to the analysis made by him 14.72 % of water, 55.77 % of crude protein, 12.35 % of fat, 10.06 % of mineral matter. The crude protein is a mixture of albuminoids (chiefly collagen), pure proteins and amides, being substances soluble in the gastric juices of animals.

As test animals there were used 9 milch cows between the 2nd and 3rd month of the lactation period. They were given as basal ration per 1000 kilograms live weight per day: 5 kg. chopped forage, 4 kg. hay, 20 kg. beetroot leaf silage, 15 kg. mangolds, 20 kg. potatoes, 1.5 kg. wheat bran, 1 kg. of lupins with the bitter taste removed. The starch value was 10.3 kg; the quantity of pure digestible protein was 1.1 kg. As cows which have just calved must usually receive 1.6 to 1.9 kg of pure digestible protein and a starch value of 9.8 to 11.2 kg, the basal ration lacked 45 to 73 % of the first element, while the starch value was fairly large. To make up the deficiency there was added to the basal ration, for one group 3 kg. of linseed cake and for the other 1.5 kg. of glue leather. The animals at once took to the latter.

The experiment, which was begun on the 20th January, was intended to continue until the 28th February. During that time the milk secretion was 10 % less in the glue leather group, but the milk was a little richer in fat.

The difference between the production of the two groups being small, the experiment was continued until the 23rd March. The group which at first received glue leather was then given linseed oil cake, and vice-versa. During this second period, the cows receiving glue leather gave somewhat more abundant and more fatty milk: this increase in the percentage of fat was also observed in the first period.

Assuming that the linseed cake caused the production of 100 parts of milk and 100 parts of fat, the glue leather produced 98 and 102 parts respectively.

In conclusion, glue leather is recommended as a good concentrate for cows in milk.

774 - **Skim Milk with an Addition of Sweetened Flour for Rearing Sucking Calves.** — EDIN HAROLD in *Kungl. Landtbruks-Akademiens Handlingar, och Tidskrift*. Year IV, Nos. 1-2, pp. 83-120. Stockholm 1916.

In Sweden, 1 700 000 calves are produced annually of which only 400 000 are reared, the others going to the butcher. The majority are sold shortly after birth, when the meat has not yet "set" and the price is always low, not exceeding 19s. 7d. per cwt. live weight.

(1) In connection with the use of this substance in pig feeding, see *B.* 1915, No. 1064. (*Ed.*)

During the period 1912-1914, a series of experiments were carried out at Knistad, in order to ascertain whether skim milk with sugared flour added to it can suitably replace full cream milk, so as to rear the calves with advantage until, in consequence of the improved quality of the meat and increased weight, they are better suited for the market. The food mixture is prepared as follows :

To 22 lb. of oat flour, mixed with wheat, rye or maize flour there is added 3.3 galls. of skim milk and 3.3 galls. of water. The whole is heated and when it begins to boil, the pan is taken off the fire and the contents allowed to cool to 60° C, after which very fine powdered sugar is added in the proportion of $^1/_{10}$ of the flour (in this case 2.2 lbs.) mixing thoroughly until the mass, which becomes thinner, is uniformly sweetened. Finally, 4.4 galls of skim milk are added.

During the experiments results clearly positive in character were obtained :

1) Skim milk with sugared flour added can take the place partly, and subsequently entirely, of full cream milk, without any disadvantage to the normal growth of the calf, the quality of the meat alone becoming slightly inferior.

2) The best results are obtained by mixing the flour with skim milk in the proportion of one lb. to 2 gallons of milk ; greater concentration produces digestive trouble.

3) How far it is desirable to prolong this form of artificial feeding is a matter which of course varies from place to place according to the price of meat and the cost of the feed substances used.

Other experiments carried out at Biärka-Saby (Alberga) and at Gedleholm confirm the results already obtained at Knistad.

**775 – Experiments to ascertain whether the Ability to produce Milk-fat is transmitted by the Dam or the Sire.** — Woodward T. E., in *Hoard's Dairyman*, Vol. LI, No. 4, p. 146. Fort Atkinson, Wisc., February 18, 1916.

In carrying out the investigations to solve the above problem, the Advanced Registry of the American Guernsey Cattle Club was utilised.

The plan was to take the bulls having Advanced Registry daughters and pick out those daughters which had different Advanced Registry dams. If then a difference was found between the daughters it must be attributable to the dams, since the sire would remain the same in each case. When two daughters were found by the same bull, the higher and the lower producer were compared. When three daughters were found, the highest and lowest were compared and the third discarded ; and when four were found two comparisons were made possible. In every case an even number of daughters was used, except when two or more had the same dam, in which event the records of all out of the same dam were averaged and treated as only one animal.

A total of 384 daughters having tested dams was found, which allowed of 192 comparisons. In 110 cases out of 192 (57.3%) the high producing daughters were from dams with the higher records. The average fat production was as follows :

| | Pounds |
|---|---|
| 192 low producing daughters | 435.88 |
| 192 high producing daughters | 548.10 |
| Dams of low producing daughters | 473.50 |
| Dams of high producing daughters | 500.57 |

The influence of the dam on fat-production is evident. Compiling the data in another way, we have :

| | Pounds |
|---|---|
| 192 low producing dams | 428.07 |
| 192 high producing dams | 546.22 |
| Daughters of low producing dams | 482.86 |
| Daughters of high producing dams | 500.61 |

While there is a difference of 118 pounds of fat between the high and low producing dams, there is a difference of only 18 pounds between the daughters. This indicates that the sire also has something to do with the inheritance of dairy quality.

By dividing the dams into two groups, regardless of the bull to which they were bred, placing in one group all cows producing 500 lbs. or more and in the other all producing under 500 pounds, we have the following :

| | |
|---|---|
| Number of dams producing 500 pounds or more | 132 |
| Number of dams producing less than 500 pounds | 252 |

| | Lbs. fat |
|---|---|
| Average of high producing dams | 599.05 |
| Average of low producing dams | 428.53 |
| Average of daughters of high producing dams | 532.87 |
| Average of daughters of low producing dams | 470.18 |

All the methods of comparison strongly indicate that fat-producing ability is inherited from the dam as well as from the sire, and that the practice of retaining heifer calves from the best cows for replenishing and building up the herd is sound. The fact, sometimes observed, that with poorer quality cows and selected bulls high producing daughters have been obtained, must be chiefly considered as an exception which should not be made the basis in the selection of dairy cows for increased milk production.

776 – **List of Champion Cows of the 5 Principal Dairy Breeds of the United States in 1915.** — *Hoard's Dairyman*, Vol. II, No. 4, p. 143. Fort Atkinson, Wisc., February 18, 1916.

On the 1st January 1916 the cows in each breed yielding the highest semi-official yearly records in the United States, as communicated by the Secretariates of the several breeding associations, were as follows :

*Ayrshire.*

| Class | Name | Milk | Fat |
|---|---|---|---|
| — | — | lbs. | lbs. |
| 5 years old and over | Garclaugh May Mischief | 25,329 | 894.30 |
| | Lily of Willowmoor | 22,596 | 955.56 |
| 4 ½ to 5 years | Miss Nox 3d | 15,015 | 576.94 |
| 4 to 4 ½ years | Agnes Wallace of Maple Grove | 17,657 | 821.45 |
| 3 ½ to 4 years | Elizabeth of Juneau | 15,122 | 536.15 |
| | The Abbess of Torr | 14,582 | 640.72 |
| 3 to 3 ½ years | Ethel of South Farm | 15,056 | 589.20 |
| 2 ½ to 3 years | Henderson's Daity Gem | 17,974 | 738.82 |
| 2 to 2 ½ years | Jean Armour 3d | 14,987 | 599.91 |

*Brown Swiss.*

| Class | Name | Milk | Fat |
|---|---|---|---|
| — | — | lbs. | lbs. |
| Mature | College Bravura 2nd | 19,461 | 798.16 |
| Five-year-old | Rosalind B. | 16,804 | 727.64 |
| Five-year-old | Ethel B. | 17,343 | 710.99 |
| Four-year-old | Merry of Allynhurst | 14,371 | 578.87 |
| Three-year-old | Hundry | 14,087 | 574.52 |
| Three-year-old | Ha B. | 15,603 | 548.92 |
| Two-year-old | Elsie of Lake View | 13,149 | 486.91 |

*Guernsey.*

| Class | Name | Milk | Fat |
|---|---|---|---|
| — | — | lbs. | lbs. |
| 5 years old and over | Murne Cowan | 24,008 | 1098.18 |
| 4 ½ to 5 years | Dairymaid of Pinehurst | 17,285 | 910.67 |
| 4 to 4 ½ years | Azucena's Price 2d | 16,204 | 855.70 |
| 3 ½ to 4 years | Dolly Dimple | 18,459 | 906.89 |
| 3 to 3 ½ years | Johanna Chene | 16,187 | 863.36 |
| 2 ½ to 3 years | Langwater Hope | 15,079 | 773.59 |
| 2 to 2 ½ years | Cherry of Edgewater | 13,454 | 732.97 |
| 2 to 2 ½ years | Marshall's Lady Dudley | 14,814 | 606.46 |

*Holstein-Friesian.*

| Class | Name | Milk | Fat |
|---|---|---|---|
| — | — | lbs. | lbs. |
| 5 years old and over | Duchess Skylark Ormsby | 27,761.7 | 1205.09 |
| 5 years old and over | Tilly Alcartra | 30,451.4 | 951.23 |
| 4 ½ to 5 years | Lucile Jolie Pontiac | 23,830.2 | 938.52 |
| 4 ½ to 5 years | Irma Gilt Edge Queen 2d | 26,745.3 | 758.88 |
| 4 to 4 ½ years | Daisy Grace De Kol | 21,718.3 | 962.80 |
| 4 to 4 ½ years | Queen of the Hengervelds | 23,788.1 | 702.46 |
| 3 ½ to 4 years | Duchess Hengerveld Korndyke | 22,897.0 | 903.38 |
| 3 ½ to 4 years | Friend Echo Elnora | 23,148.6 | 732.70 |
| 3 to 3 ½ years | Finderne Holingen Fayne | 24,612.8 | 1116.05 |
| 2 ½ to 3 years | K. P. Manor Kate | 22,106.4 | 818.73 |
| 2 to 2 ½ years | Finderne Mutual Fayne | 22,150.4 | 960.51 |
| 2 to 2 ½ years | Elmside Nudine Segis Johanna | 22.802.3 | 706.40 |
| Under 2 years | Woodcrest Colantha Pietje | 20,859.7 | 639.62 |

*Jersey.*

| Class | Name | Milk lbs. | Fat lbs. |
|---|---|---|---|
| 5 years old and over | Sophie 19th of Hood Farm | 17,557.7 | 991.1 |
| 5 years old and over | Passport | 19,694.8 | 839.3 |
| 4 ½ to 5 years | Olympia's Fern | 16,147.8 | 937.8 |
| 4 to 4 ½ years | Lass 64th of Hood Farm | 13,444.6 | 817.8 |
| 4 to 4 ½ years | Flying Fox's Maid | 14,315.6 | 785.9 |
| 3 ½ to 4 years | Lass 66th of Hood Farm | 17,793.8 | 910.6 |
| 3 to 3 ½ years | Lass 74th of Hood Farm | 13,713.9 | 747.6 |
| 3 to 3 ½ years | Lucky Farce | 14,184.8 | 708.5 |
| 2 ½ to 3 years | Lad's Lady Riotress Irene | 12,307.8 | 660.8 |
| 2 to 2 ½ years | Pearly's Exile of St. Lambert | 12,345.5 | 816.1 |
| 2 to 2 ½ years | Lass 66th of Hood Farm | 14,513.1 | 720.5 |
| Under 2 years | Lucky Farce | 14,260 | 635.8 |

PIGS

777 - **The Guernsey Breed of Cattle in Italy.** — BARTOLUCCI A., in *L'industria lattiera e zootecnica*, XIVth Year, No. 5, pp. 68-69 ;No. 8, pp. 117-119; 7 fig. Reggio d'Emilia, March 1st and April 15, 1916.

One of the first attempts at introduction and acclimatisation of the Guernsey breed in Italy was made by COUNT SENNI at Grottaferrata, province of Rome, on a farm rich in forage and possessing byres containing all up to date improvements. The imported specimens, male and female, as well as the pure products, have retained all the original characteristics, as well as capacity for milk production, the organoleptic characters, and the composition of the milk and butter. The pure progeny have been selected and crossed with cows of the Lombard, Brown Swiss and Dutch type. It has thus been possible to prove the preponderant character of the Guernsey bull in transmission by inheritance. In all the cases, the milk production of the females obtained from these crosses was larger and better than that of their dams.

778 - **Experiments in Pig Feeding with Potato Peel.** — ZUNTZ and VON DER HEIDE, in *Deutsche landwirtschaftliche Presse*, 43rd Year, No. 31, p. 276. Berlin, April 15, 1916.

The Authors carried out 2 experiments at the Physiological Institute of the University of Berlin in feeding pigs with potato peel in the form of Berlin kitchen refuse.

In the first experiment, this peel, well dried, then coarsely ground, was administered with a basal ration to 3 pigs. It was found that pigs of a weight of 66 to 88 lbs can easily take 1.1 lbs. of dried peel per day per head.

A second experiment, in which 1 pig received 1.1 lbs. of potato peel and 0.22 lbs. of desiccated full cream milk per day, and was put into a respiration chamber, showed that the crude cellulose of the peel is much less digestible than that of the whole potato, which is quite intelligible. This matters little, however, because the content of crude cellulose is small relatively to the other nutritive elements, and the content of non-nitrogenous extract is almost equal to that of whole dried potatoes. The crude protein is difficult to digest, but the figures of digestibility are not much below those found by KELLNER for dried potatoes.

In conclusion, the food value of the peel equals 80.6 % of the potato substance. The disadvantage of the peel is that the animal will not take it in large quantities for a sufficiently long period, the result being that few proteins are formed in their bodies.

779 – **Experiments in Feeding Pigs with Straw Meal and Straw rendered Soluble by Caustic Soda.** — SCHNEIDEWIND, in *Landwirtschaftliche Wochenschrift für die Provinz Sachsen*, 18th Year, No. 7, pp. 57-59. Halle a. S. February 12, 1996.

The straw made soluble by a solution of caustic soda used in this experiment, first manufactured in Germany by OEXMANN and sold under the name of "Zellulosefutter" (cellulose forage), generally contains 65 % of pure ligneous substance, 20 % of dried potato, and 15 % of molasses. The straw meal, finely ground cost 12 *s.* per cwt. The two forages were compared with sliced potatoes.

The test animals were 12 growing pigs divided into 4 equal groups, each fed as follows :

| | |
|---|---|
| *Group I* | Crushed barley, first 2.2 lbs.; afterwards 3.3 lbs.<br>Boiled potatoes 19.8 lbs.<br>Fish meal, 1.5 lbs. |
| *Group II* | Crushed barley, first 2.2 lbs.; afterwards 4.4. lbs.<br>Sliced potatoes, 6.6. lbs. |
| *Group III* | Crushed barley, first 2.2 lbs; afterwards 4.4. lbs.<br>Cellulose forage, 6.6. lbs. |
| *Group IV* | Crushed barley, first 2.2. lbs; afterwards 4.4 lbs.<br>Straw meal, 6.6 lbs. |

The supplementary forage was properly mixed with basal forage.

The experiment proper, which was preceded by a preparatory period, lasted 61 days and took a normal course. During this period it was observed that the pigs of Group IV (receiving straw meal) did not take to their ration willingly. On completion of the experiment, these animals were found to be more poorly constituted.

The following was the daily increase of weight per animal in the different groups :

| | | |
|---|---|---|
| *Group I* | (without supplementary forage) . . . . . | 0.86 lb. |
| *Group II* | (with sliced potatoes) . . . . . | 1.1 " |
| *Group III* | (with cellulose forage) . . . . . | 0.90 " |
| *Group IV* | (with straw meal) . . . . . | 0.44 " |

The Writer concludes that the productive value of cellulose forage is equal to about 50 % of the value of sliced potatoes, and that straw meal is valueless as food for pigs.

780 – **Value of Lucerne and other Green Forage in Pig Feeding.** — NILS STANSSON in *Kungl. Landtbruks-Akademiens Standlingar och Tidskrift*, Year XLV, Nos. 1-2 pp. 30-56. Stockholm, 1916.

Researches were conducted at the Central Livestock Breeding Station at Stockholm with the object of ascertaining to what extent green forage can be used in feeding young pigs. The animals experimented on were

subdivided into two groups ; (A) Control group with rations of milk serum, skim milk and barley ; (B) Test group in which the serum, milk or barley are in part or in different proportions replaced by lucerne, vetches or green clover. The results may be summed up as follows :

1) Green forage may form part of the daily ration to the extent of 10 % of the total weight without the growth of the animals suffering in any way.

The nutritive value of fresh hay depends on the weather and is generally higher in summer than in winter crops.

2) Lucerne and clover have nearly the same value, so that 2.2 lbs. of barley may be replacd by 15.4 to 16.5 lbs. of lucerne or clover. Vetches, owing to the lower percentage of dry substance, are much below the other two pulses ; 19.8 to 22 lbs. of vetches correspond to 2.2 lbs. of barley.

3) Steeping and cooking the forage have no marked influence on the daily growth of the animals, as appears from the following table :

| | With fresh forage | With wet forage | With cooked forage |
|---|---|---|---|
| Lucerne | 1.040 lbs | 1.058 lbs | — lbs |
| Vetches | 0.968 | 0.805 | 0.904 |
| " | 0.968 | 1.069 | — |
| Clover | 1.273 | 1.284 | 1.273 |
| " | 1.205 | 1.157 | — |
| Average of 5 experiments. | 0.091 | 1.065 | — |
| " " 2 " | 0.122 | 1.045 | 1.089 |

Finally it was remarked that the dead weight is greater in the pigs of the test group partly fed with green forage.

| | Percentage of loss of weight in killing | |
|---|---|---|
| | In the test group | In the control group |
| Lucerne-Serum | 26.3 | 25.2 |
| » Skim milk | 26.3 | 24.2 |
| » Barley | 27.7 | 25.7 |
| Vetches-Seum | 23.8 | 21.8 |
| Clover-Serum | 23.2 | 28.8 |
| » Lucerne | 25.5 | 23.7 |

POULTRY

781 – **Experiments on the Necessity of adding Gravel to Poultry Food.** — Búzás Gy., in *Baromfitenyesztok* (Poultry Keepers), Year XI, No. 6, pp. 68-70. Budapest, April 1916.

In order to ascertain whether there is any advantage in adding small gravel to the food of fattening chickens, as is done by most Hungarian poultry preeders, Mr. A. Zaitschek, Chief Royal Chemist, undertook a series of experiments. Their object was, at the same time, to gain further knowledge about the gizzard of graminiverous birds, and ascertain whether the small gravel always found in the gizzard of poultry is an indispensable mechanical factor in digestion.

The tests covered 3 groups of 6 chickens, kept from the 14th September to the 28th November on a diet of maize, partly whole, partly ground. While group II was given carefully screened maize free from all gravel, group I

was also given a weighed quantity of gravel, in portions renewed as and when the birds consumed the contents of their trough, so that during the entire experiment each chicken of group I swallowed about 600 grams of gravel. The weight of the gravel varied from 0.14 to 0.24 gr. per grain; the width from 1.2 to 7 mm. and the length from 1 to 10.5 mm. To get rid of soluble parts the gravel was first scorched in a flame, then, before administration, was boiled in dilute hydrochloric acid, and afterwards in water. The average daily ration given per individual was almost equal in both groups: in group I, each subject consumed 73.4 gr. of maize, and in group II, 72.4 g. In the course of the experiments the chickens were often weighed (the results are indicated in 2 tables). In both groups there were birds whose weight increased during the 2 ½ months of experiment, and others whose weight diminished. The latter were the majority, so that at the end of the experiment the weight of the birds of the 1st group showed a reduction of 314 grams (averaging 52.3 per individual), and that of the 6 birds of group II a reduction of 597 gr. (99.5 gr. average per individual).

Allowing for the daily ration of group II, which was 1 gram less, it may be concluded from the above results that the 2 groups assimilated their food in an equal degree, so that from the point of view of grain utilisation it is quite immaterial whether it is administed with or without gravel. In the average change of live weight there was a very small difference between the 2 groups, and it was concluded that the live weight of the birds fed with maize with or without gravel varied uniformly.

At the end of the experiment, the gizzards of the birds of each of the 2 groups were examined, and gravel was found which was carefully cleaned and then weighed. The gizzards of the birds of group I contained on the average 13 grams of such gravel, while in those of group II there was an average of 6 gr. As however the chickens of group II received no gravel during the test, it is evident that they kept it in the gizzard for about 2 ½ months, which suggests that they use it for grinding the grain swallowed, and that the anatomical construction of the gizzard is such as to render the expulsion of the gravel difficult. (RÉAUMUR had already recognised the necessity for the presence of gravel in the gizzard of graminivorous birds).

The 2 757 grains of gravel found in group I weighed together 52.7 gr. (0.019 gr. per grain); in group II, 667 grains weighed together 29.5 gr. (0.44 gr. per grain), which shows that the birds of group II kept bigger grains of gravel. There were also differences in the shape of the gravel; that of group II was rounder and smoother, which must be attributed to the continuous friction in the gizzard. Finally, the grains of gravel weighing 13 grams found in group I prove that the greater part of the gravel was evacuated with the excrement, as the birds of this group had still received 60 grams of gravel on the average, 10 days before being killed.

It follows from these observations that gravel may be dispensed with during the short period of fattening of chickens (intensive fattening lasts 15 days at most), because in the gizzard of poultry there is always the necessary quantity of gravel for grinding the grain. It still remains to be ascertained, however, whether digestion takes place perfectly in case of com-

plete absence of gravel. To clear up this question it would be necessary to prevent newly hatched chicks from swallowing gravel. The fact that the hen brings gravel to the chicks with the very first food containing grain seems to confirm the opinion that gravel is indispensable for mechanical digestion.

BEES

782 - **Cold as the Cause of the Death of Bees in a Colony Wintering under Good Conditions** (1). — ASTOR A., in *L'Apiculture*, Year 60, No. 3-4, pp. 28-31. Paris, March-April 1916.

In all hives, even those wintering under good conditions, both from the point of view of population and food supply, ventilation, etc., a number of bees always die during winter confinement. This number varies according to the size of the colony, the number of old bees in the autumn, etc., ranging usually from one hundred to one thousand per hive. The writer has found that cold is the cause of the death of the bees. He picked up every morning the bees which had fallen lifeless on the floor of the hive. These apparently dead bees, which if left alone would no doubt die shortly, were put in a queen bee cage made of metal gauze, and gently warmed. The majority of them were restored to life by the warming only, regaining their full vigour and liveliness.

The computation of the bees falling lifeless every day and those restored by warming, and dead bees leads to the following conclusions :

The number of lifeless bees taken from the floor of the hive and the percentage of dead bees relatively to those lifeless in appearance is larger in proportion as the temperature is lower, and vice-versa.

At least 80 % of the bees which perish during the winter in a colony wintering under good conditions are killed by cold.

PISCICULTURE

783 - **A New Skin Disease in Carp in Germany.** — PLEHN M., in *Allgemeine Fischerei-Zeitung*, Year 1915, No. 12, pp. 179-180. Munich, 1915.

A description is given of a skin disease, hitherto unknown, which caused great damage in 1915 in fish ponds in Germany. The first symptoms are one or more characteristic dark spots on the skin, which gradually spread and finally reach the size of a 5 shilling piece. The colour sometimes disappears, but mostly a hole forms in the middle of the spot ; it is shallow, being limited to the subcutaneous layer, which then gives it a fine white colour. The white hole is surrounded by a darker zone which gradually grows fainter. These are the typical symptoms of the disease.

Cases are also observed in which the subcutaneous layer is attacked; it comes away in pieces which float in the water. Below the subcutaneous part attacked, a hole forms in the flesh, the dark colour of the zone loses its intensity, and finally a characteristic abscess forms.

The diseased skin contains enormous quantities of bacteria, and it is beyond doubt that one of these bacteria is the pathogenic agent in the disease. It was however impossible to find the presumed pathogenic agent, and the Writer asks all fish breeders and investigators to communicate to him in detail their observations on the disease.

(1) See *B.* 1915, No. 209. (*Ed.*)

The disease often causes the death of the fish, but only when the latter is greatly enfeebled. In some cases recovery may take place.

The dead fish being entirely invaded with bacteria, it was not possible to ascertain where they enter.

The study of the disease is being continued.

## FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

784 - **Strecker's Liquid-manure Drill.** — STRECKER, in *Deutsche Landwirtschaftliche Presse*, 43rd Year, No. 33, p. 293 ; No. 34, p. 304 + Fig. Berlin, April 22 and 26,1916.

A series of definite principles have been devised in connection with the preparation, storage and use of liquid manure but up to the present there has been no suitable apparatus for *putting it into the soil* in accordance with these principles. It is requisite that the liquid manure should not leave the distributing cask or barrel in a large jet which comes into contact with the air before reaching the soil ; it must be introduced direct into the soil, and protected against air. This condition is complied with by the " Jauche-drill " (liquid manure drill) of Professor STRECKER, of which the appended figure represents a general view.

After trying all sorts of contrivances, the inventor at last satisfied himself that the best method of preventing access of air consists in the use of steel discs (*g*) similar to those of mechanical seed drills. Small pointed drill shares, with guide roller and adjusting bar gear, precede the discs, cutting into the soil so that the discs can afterwards pass in the purin and cover it up with earth at once. The result is that the purin flowing in a big jet into the " Schartrichter " (funnelshare) *m* (fig. 2) at once disappears completely in the soil and cannot evaporate in the air. For light soils a share consisting of the funnel *x* and the slide *y* (fig. 3) is sufficient.

The inventor adjusts the apparatus according to the quantity of liquid manure by means of adjustment rings (fig. 4), the aperture of which is made to correspond with the opening 7 (fig. 5).

To enable the device to work on a slope, the distributing pipe 3 is suspended pendulum-wise to the chain 12, and therefore always remains horizontal.

In order to adapt the distributing mechanism to different crops the method is the same as with a seed drill : the lever-stirrups *e* on the lever-carrying bar *d* are moved more or less apart according to the space between the rows.

The liquid manure emerging from the barrel through the tap 1 flows through a flexible tube into the distribution pipe 3, from which it passes down through the socket pipes 11 (figs. 2 and 3) into the funnels *m* closing with airtight lids *n*, and afterawrds between the steel discs, thus getting to a depth of about 6 cm in the soil where it is immediately covered with earth.

This easily handled appliance is made in different sizes for operation by hand or by horses.

STRECKER'S *Liquid-manure Drill.*

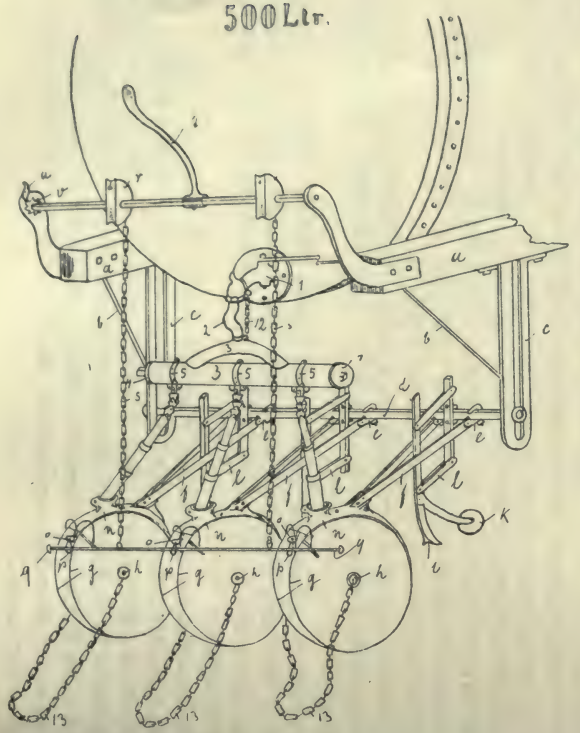



*Fig. 1*

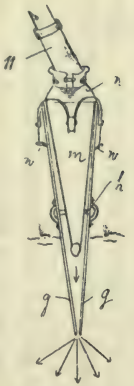


*Fig. 2*

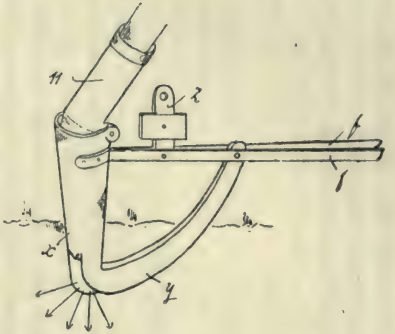


*Fig. 3*

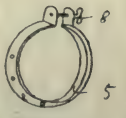


*Fig. 4*

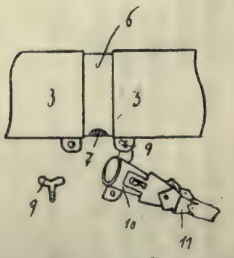


*Fig. 5*

785 - **Vasino Winnowing Machine.** — TARCHETTI A. in *Giornale di Risicoltura*, VIth Year, No. 8, pp. 136-142, fig. Vercelli, April 30, 1916.

This simple appliance possesses the following advantages over ordinary winnowers :

1) It only runs at a given speed, which prevents excessive increase of the quantity fed in, and hasty and bad work.

2) The product leaving the machine is put up automatically in a very easy way into bags at the rear end.

3) The machine is fully equal to other winnowers in yield, but furnishes a much cleaner product with better separation of the screenings.

*Winnowing Machine* VASINO.

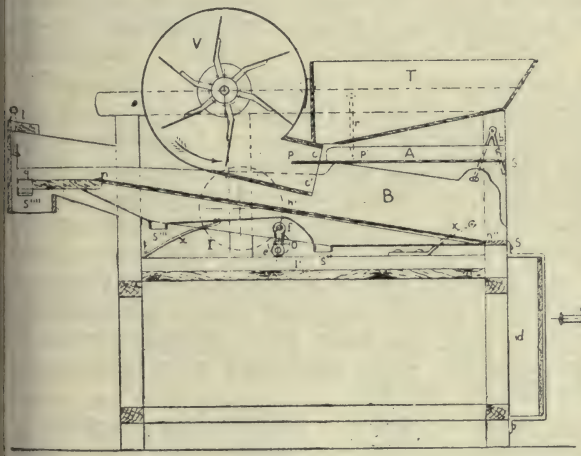



Fig. 1 : Longitudinal Section.

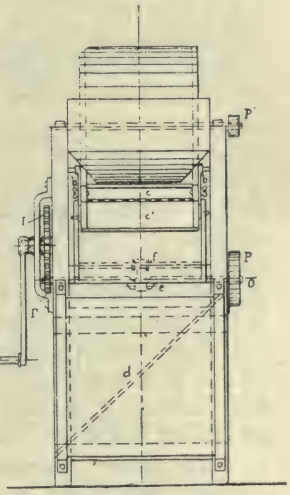



Fig. 2 : Transverse Section.

4) It can be used both for paddy and other cereals without distinction, it being only necessary to change the screens and the direction of the air current.

5) It consumes less driving power ; a boy can work it for a long time.

As shown by the 2 figures appended, this machine (which Messrs VASINO afterwards improved in its details) consists essentially of the following parts : a wooden frame, a fan V, a feed hopper T, and two screens, A and B.

The machine is hand-driven by means of the crank *m*, the movement of which is transmitted through the gearings I and I', to the shaft *o*, which in turn transmits it to the screens through the elbow-joint and the connecting rod *e f* ; and to the fan through the pulleys P, P' and the belt.

The material contained in the hopper T falls on the 1st screen A, which is a cast iron plate, suspended to the frame by the springs *r* and the 2 arm levers *b*, one being short for the purpose of regulating the screen angle, and

the other long and connected to the edges B of the lower screen, which imparts a rocking movement to it. The screen A is not perforated at its end *p p'* lying below the discharge aperture of the hopper, so that the material from the latter has to pass over to *p'* before dropping through to the bottom screen. Through a regulator placed against the vertical wall of the hopper, and by which the fan box may be turned, the fan outlet aperture may be raised or lowered so as to enlarge either the part *c* which blows *on to* the screen A, or the part *c'* which blows *below* the same screen. From *p'* to *s* the latter is perforated, not by punched holess, but by small arched notches with convex edge bent downwards spoonwise, so as to facilitate the entry of the current of air from below upwards and the descent of the small grain and seeds, while the large grains fall from *s* into the inclined plane *d* and the small straw, empty grains, etc., are expelled from the machine by the air current.

During the drop from A to B, the grains are struck by the air current *c'* and compelled to follow an inclined path which brings them near the end *n''* of the lower screen. The latter is supported laterally by the wooden edges B to which is fixed the shaft *f* receiving the movement of the 4 springs *x* and *x'* supporting the screen as a whole. The result is that the latter, which under the action of the connecting rod *e f* tended to perform a perfectly vertical alternating movement, is compelled on the contrary to shift along 2 arcs of a circle with radii which are respectively equal in the lower part to the lever arm *x'* and in the upper part to the lever arm *x*. In consequence of the impetus thus given by the screen to the grains covering it, the latter are thrown upwards, and in accordance with the law of uniformly varied movement, they describe a parabolic path, falling on the screen at a point farther up. They thus make small successive intermittent advances, passing up along the screen until they pass through the meshes or fall at $s^{IV}$, where they are collected.

The screen is generally made of sheet iron perforated on the space *n' n''* with small holes for separating the earth and small seeds ; on the space *n n'* with larger holes separating the bad seeds; a sheet-iron apron with a double slope placed below collects the screenings of *s''* and s''', while the stones, which cannot rise owing to their weight, fall from *s'* into the inclined plane *d*. In the aperture *q* through which the cereal descends there is an inclined plane $q\ s^{IV}$ which, by means of the lever 1 may be inclined right or left and thus feed the cereal into either of the 2 sacking inlets with which the appliance is fitted, so as to allow of continuous fall of the cereal during the connecting up and taking away of the sacks.

Thus the speed of conveyance of the cereal does not only depend on the lever arm *o e* of the elbow-joint, but also on the mutual position and the length of the screens *x* and *x'*, and still more on the rapidity of alternative movement. The effective conveyance momentum acquired by each grain weighing *p* must not only be capable of overcoming the frictional resistance against the screen and raising the grain, but also of enabling it to describe such a path that when it falls back into the screen it cannot descend again,

owing to the lowering and slope of the screen and the vibration of the apparatus, to the point from which it was raised.

Thus speed plays an essential part in the output of the apparatus and it cannot go below a certain limit, otherwise the apparatus will not work and the grains tend to descend towards the end *s'*.

786 – **The Vasino Paddy Cleaning Machine, fitted to a Threshing Machine.** — TARCHETTI A. in *Il Giornale di Risicoltura*, VIth Year, No. 9, pp. 151-154, 1 fig. Vercelli, May 15, 1916.

As shown by the appended figure, the paddy cleaning machine designed by Messrs. VASINO BROTHERS (at Ponzana, province of Novara) can be fitted beneath an ordinary machine for threshing this cereal.

The cleaning apparatus is entirely suspended by wooden supports to the lower cross-members of the framework of the thresher. It may receive the reciprocating screening movement either by means of the lever *P P* actuated by an eccentric mounted on the shaft of the 1st beater (the whole shown in dotted lines on the figure), or still better by means of a special countershaft *L*, fitted with an eccentric or elbow-joint and driven by a belt.

The cleaning apparatus does not gather everything that falls from the gratings of the thresher, but only the material from the 1st shaker and the 2nd beater, because generally the products of the 1st beater do not need cleaning, while those of the last shakers are so full of impurities, and at the same time so small, that it is desirable to blow them separately by hand.

The threshing product falls on an inclined plane (which MESSRS VASINO have divided with advantage into several parts: *A*, *A'*, *A''*, to save space in height), which conveys it to the 1st screen B. The latter may be of perforated sheet iron, but the inventors prefer plates with *oblique* holes (shown in a vertical section on the principal figure, and in plan on the small figure annexed) in order the better to prevent leaves, stalk fragments, glumes, etc. from passing into the lower part.

The nozzle of the fan divides into 2 branches, *M* and *N*, at the entrance to which is a slide valve by which the current of air in both may be regulated.

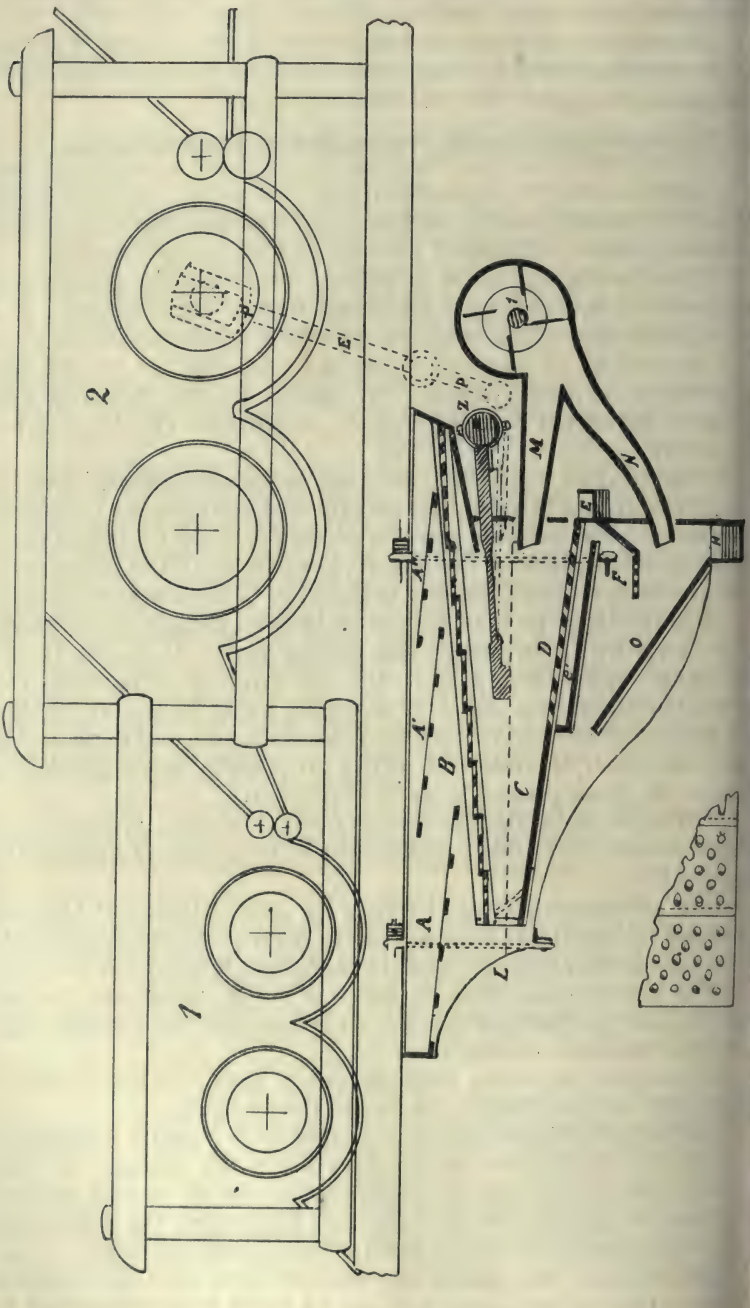
The air emerging from *M* strikes the grain falling from the sieve *B* and separates the small straw, empty grains, light seeds and dust, ejecting them from the machine together with the leaves etc. falling from the end of *B*.

The heavy grains drop on the 2nd screen, which has a solid part *C* and the rest punched out like the 1st screen, but with smaller holes, with a reverse direction of slope at *D*.

The stones and other large impurities gather in the channel *E*, from which they are expelled at one side of the machine.

The paddy falls into the plane *C'*, then on to *F*, and *G*, and into the channel *H*, which discharges it on the other side of the cleaner. In falling from *F* to *G*, however, the paddy is subjected to the air current of the channel *N*, which, striking against *G*, forms an eddy holding the screens suspended for some moments and freeing them from the last impurities.

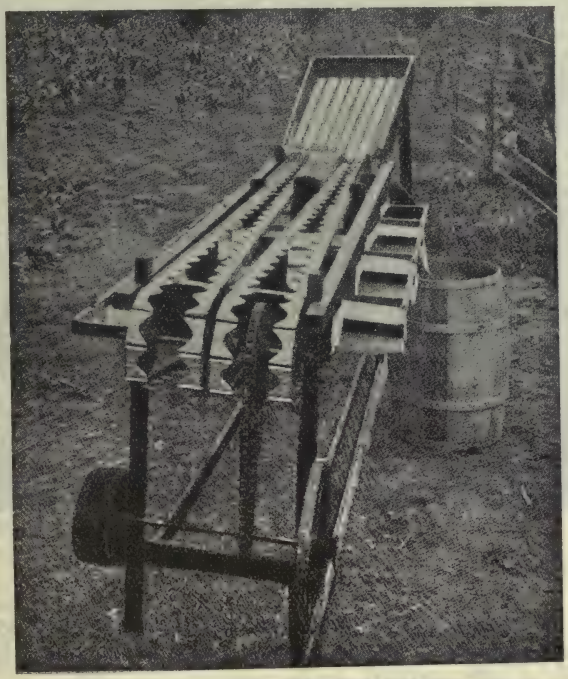
This cleaner, both simple and efficient, does not take up much space, requires little driving power and can be fitted to any threshing machine.




VASINO *Cleaner fitted beneath Threshing Machine.*

787 – **Motor-Driven Apple Grading Machine of High Capacity** (1). — *The Scientific American*, Vol. CXIV, No. 15, p. 385. New York, April 8, 1916.

The new apple-grading machine shown in the accompanying figure is operated by motor power and has a capacity varying from 40 to 60 barrels per hour. The apples can be graded in seven different sizes from 2 ¼ inches up to 4 ½ in. in diameter, each size varying one quarter of an inch. The principle on which the grader is designed and constructed is very



Mechanical Apple Grader.

simple. It is an endless belt with plates forming hollow squares which change their size as they travel towards the end of the grader. The variation in the size of the squares is accomplished by the spreading of he belts.

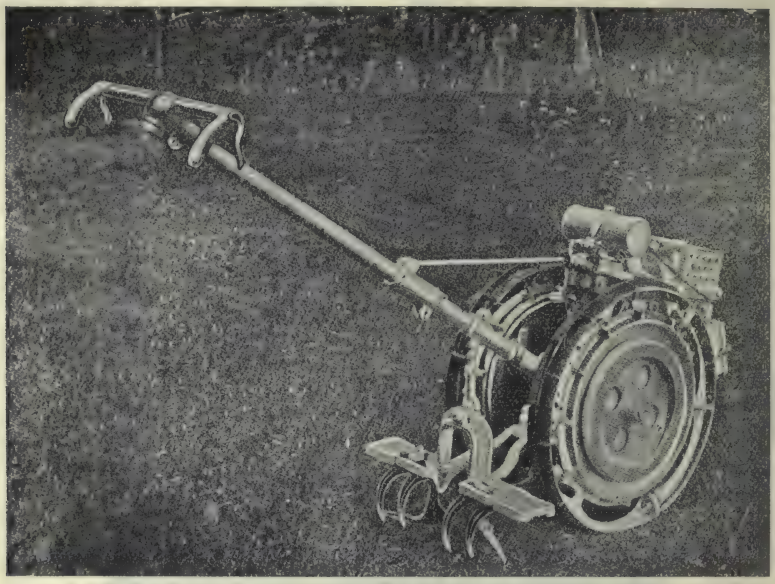
788 – **A Tractor for the Garden.** — *Farm Implement News*, Vol. XXXVII, No. 17, p. 53. Chicago, Ill., April 27, 1916.

The accompanying illustration shows the garden tractor constructed by the Beeman Garden Tractor Company of Minneapolis. Minn. U. S. It develops nearly three horse-power, the pull on the drawbar being a little

(1) See also *B.* June 1914, No. 560. (*Ed.*).

less than one horse-power. It weighs 450 pounds and has wheels 25 inches high with 3 ½ inch tires. The height of the handles can be adjusted to suit the operator. It will cultivate anything that grows in rows.

Any kind of garden hoes, cultivator teeth, knives or disks can be quickly attached and a boy or girl can operate the machine for it needs only to



The Beeman garden Tractor.

be steered. By going astride the row this tractor cultivates all vegetables grown in narrow rows such as onions, beets, carrots and by going between the rows it will cultivate maize, potatoes, peas etc.

This tractor can also be used for driving other small machines such as pumps, churns, cream separators, wood-saws and the like.

789 – **Experiments on the Fuel used in Farm Portable Engines.** — *Regence de Tunis, Direction générale de l'Agriculture, du Commerce et de la Colonisation, Bulletin*, Year 20, No. 87. pp. 49-55. Tunis, March, April 1916.

The present high prices of coals have induced many farmers in Tunis to use other fuels for their steam engines. The wood of olive trees, lentisks and thuyas are those most frequently burned.

The Direction Générale de l'Agriculture has recently caused experiments to be carried out in order to determine the best means of utilizing Tunisian fuels and their value in comparison with that of coal briquettes.

A 24 HP. portable engine driving a straw baling press turning out 40 to 50 bales per hour was used for these experiments, in each of which the pressure was first brought up to 64 lbs. by burning only the strictly

necessary quantity of fuel, then the press was started, the pressure raised to 85 lbs and kept there while the machines worked steadily for some hours after which the experiment was stopped at the initial pressure of 64 lbs. and with the same water level in the boiler.

Careful record was kept of the weight of fuel consumed, work done, time employed etc., and these data are given in the annexed table.

| Fuel | Amount required to raise pressure to 64 lb. | Consumption whilst working | | | | Material pressed |
|---|---|---|---|---|---|---|
| | | per hour | per 100 bales | per 1000 lbs. | ratio to coals | |
| | lbs | lbs | lbs | lbs | | |
| Coal briquettes | 79.2 | 39.6 | 99.0 | 13.2 | 1 : 1 | straw |
| | 79.2 | 31.5 | 110.0 | 13.2 | 1 : 1 | fodder |
| Tunis lignite from Cape Bon | 81.4 | 54.8 | 136.4 | 18.3 | 1.39 : 1 | straw |
| Wood from old olive trunks, recently felled | 165.0 | 110.0 | 275.0 | 36.8 | 2.79 : 1 | straw |
| Eucalyptus, branches and stems 2 to 10 inches diameter, felled two months previously | 162.8 | 107.8 | 253.0 | 33.8 | 2.56 : 1 | straw |
| Thuya, trunks recently felled | 180.4 | 115.3 | 288.2 | 38.5 | 2.91 : 1 | straw |
| Thuya, stumps recently felled | — | 90.6 | 275.0 | 36.8 | 2.79 : 1 | straw |
| Aleppo pine, trunks and branches, quite green | 154.0 | 110.0 | 250.8 | 33.5 | 2.54 : 1 | straw |
| Lentisk, small branches few centimetres in diam., nearly dry. | — | 84.5 | 264.0 | 31.6 | 2.39 : 1 | fodder |
| Lentisk, stumps felled some months previously | 132.0 | 116.2 | 253.0 | 33.8 | 2.56 : 1 | straw |
| Carob tree, split wood and branches recently felled | 132.0 | 117.7 | 292.6 | 35.0 | 2.65 : 1 | fodder |
| Cork-oak, split wood, nearly dry. | 125.4 | 92.0 | 275.0 | 33.2 | 2.52 : 1 | fodder |

## 790 – Review of Patents.

*Tilling machines and implements.*

Canada 167 801. Plough.

Cuba 2 452. Improvements in cultivators.

Denmark 21 099. Cultivator.
21 123 — 21 142. Ditching machines.

United-Kingdom 24 471. Subsoiler.
408. Power driven ploughs, cultivators etc.
802. Motor ploughs.

United-States 1 176 047 — 1 176 334 — 1 177 883 — 1 178 515 — 1 179 295. Harrows.
1 176 098. Soil pulverizer.
1 176 240. Roller attachment for gang ploughs.

1 176 514. Weed cutting attachment for disk-harrows.
1 176 581 — 1 178 765. Disk ploughs.
1 176 626. Combined roller and stalk cutter.
1 176 883. Combined weeder and cultivator.
1 176 892. — 1 177 649 — 1 178 660 — 1 178 607. Ploughs.
1 176 955. Attachment for cotton choppers.
1 177 175. Insect trapping attachment for cultivators.
1 177 389 — 1 178 025 — 1 180 178. Cultivators.
1 177 558 — 1 177 871. Gang ploughs.
1 177 974. Weeder.
1 178 212 — 1 180 477. Motor ploughs.
1 178 767. Ridge levelling harrow.
1 179 183. Tractor plough.
1 179 241. Plough beam.
1 179 315. Plant hill marker.
1 179 899. Deep-tilling gang plough.
1 180 195. Adjustable draught attachment for ploughs.
1 180 456. Coulter brace.
1 180 563. Clamps for cultivator standards.
1 180 580. Coulter.
1 180 845. Disk harrow.

*Manure distributors.*

Canada 167 719. Fertilizer distributor.
United States 1 177 391 — 1 178 137. Manure spreaders.
1 180 988. Straw and manure spreader.

*Drills and sowing machines.*

Canada 167 950. Sowing machine.
United-Kingdom 1 481. Machine for sowing seeds one at a time or for planting potatoes.
United States 1 176 222. Seed planter.
1 176 242. Corn planter.
1 176 324. Beet planter.
1 176 820 — 1 176 821. Variable drop seed planters.
1 176 906. Grain drill attachment for coulters.
1 178 263. Potato planter.
1 178 311. Seeder attachment for cultivators.
1 178 506. Combined planting and fertilizer distributing machine.
1 178 571. Grain feeding device.
1 178 766 — 1 180 759. Planters.
1 179 285. Cotton planter.
1 179 579. Covering attachment for seed planters.

*Reapers, mowers and other harvesting machines.*

Canada 167 260. Finger attachment for harvesters.
167 571. Sheaf loader.
167 786. Machine for pulling flax.
France 479 594. Hand rake for forage crops.
Switzerland 72 457. Mowers.
72 597. Hay harvesting machine.
United States 1 176 276. Corn harvesting and shocking machine.
1 176 361. Binder.
1 176 398 — 1 178 013 — 1 179 290 — 1 179 410. Corn harvesters.

1 176 547. Grain shocking machine.
1 176 585. Machine for making shocks.
1 177 104 — 1 178 634. Harvesting machines.
1 177 158. Cow-pea cutter.
1 177 475. Bean harvester.
1 178 419. Grain binder.
1 178 524 — 1 179 702. Mowers.
1 178 590. Brake for header harvesting machine.
1 179 310. Mower attachment.
1 179 320. Unloader and stacker for wheat and the like.
1 179 676. Hay rake attachment.
1 179 997. Self binding harvester.
1 180 257. Binder carrying device.
1 180 548. Corn stripper.
1 180 700. Combined hay stacker and rake.
1 180 944. Pea thresher and harvester.
1 181 094. Attachment for binders, harvesters and the like.
1 181 096. Hay rake and loader.

*Machines for lifting root crops.*

Denmark. 21 093. Machine for lifting, topping and heaping root crops.
United-Kingdom 386. Topping and tailing machine for root crops.
975. Potato digger.
United States 1 176 104. Beet digging machine.
1 176 850. Sugar beet topper and puller.
1 179 580. Potato digging machine.
1 179 767. Beet harvester.
1 180 251. Potato digger.

*Threshing and winnowing machines.*

Canada 167 193. Grain separator.
United States 1 176 360. Corn husker.
1 176 488 — 1 179 806 — 1 180 443. Threshing machines.
1 177 049. Double delivering mechanism for threshing machines.
1 177 703. Combined wild-oat separator and grain separator and cleaner.
1 178 295. Grain separator.
1 179 254. Seed separating mechanism.
1 179 438. Corn husking machine.
1 180 165. Seed grader.

*Machines and implements for the preparation and storage of grain, fodder, etc.*

Denmark 21 143. Device in straw presses with sliding ram.
United-Kingdom 1 161. Apparatus for washing grain.

*Dairying machine and implements.*

Canada 167 953. Cream separator.
Denmark 21 106. Improvement of parts of milking machines.

*Other agricultural machines and implements.*

British India 2 225. Improvement in devices for controlling supply of water for irrigation purposes.
Canada 167 539. Straw rope twister.
167 632. Hide removing instrument.

| | |
|---|---|
| Cuba | 2 453. Improvement in sugar mills. |
| | 2 458. Improvement in machines for stripping sugarcane leaves. |
| | 2 466. Filter-press. |
| Denmark | 21 127. Plant thinning machine. |
| | 21 128. Device for the cooling of preserve glasses and jars. |
| | 21 155. Link for iron tether. |
| France | 479 538. Sprayer utilizing bicycle pumps as source of pressure. |
| United-Kingdom | 193. Foster mother for chickens. |
| | 787. Machine for preparing fibres for spinning. |
| | 789. Tea rolling machine. |
| | 1 255. Machine for thinning root crops. |
| | 1 323. Insect traps. |
| United States | 1 176 182 — 1 178 552 — 1 178 993 — 1 180 962. Traction engines. |
| | 1 177 497. Calf weaner. |
| | 1 177 783 — 1 178 761 — 1 178 838 — 1 179 066 — 1 179 900 — 1 180 476 Tractors. |
| | 1 178 782. Corn topper. |

BUILDING CONSTRUCTION

791 – **Inverted Siphons Replace Bridges where Canals Cross Roads.** — *The Engineering Record*, Vol. 73, No. 15, p. 478. New York, April 8, 1916.

The extensive system of main irrigation canals and laterals in the Imperial Valley California has presented in many places the problem of getting the highways across the canals without interfering with the function of either. Bridges were built across the larger canals but as the channels are above ground level, heavy gradients were required for the approaches.

It was formerly believed that inverted siphons would not be feasible on account of the quantities of silt carried by the irrigation water and which it was feared would fill up an under-ground conduit. Experiment, however, has proved that velocities of 2ft. per second would keep the corrugated pipe siphons clear of silt although 3ft. per second is desirable for carrying the heavier sands. As a result a great many siphons have been installed and this has led to a much more satisfactory road system.

A number of these siphons are of corrugated iron pipe with collars and head walls of concrete ; others, where concrete material is lacking have timber head walls. It has been found that Oregon pine inlet and outlet walls last about eight years in the dry soil and this is considered as suitable as more permanent work.

The inverted siphon method obviates all difficulties where it is necessary to carry two canals across a road and across each other. This is now done by means of two siphons, one beneath the other.

792 – **Small Irrigation Canals Lined with Concrete to Prevent Seepage Water Loss.** — EDWARDS, C. E. in *Engineering Record*, Vol. 73, Nos. 16 and 17, pp. 508-510 and 539-541. New York, April 15 and 22, 1916.

As a result of lining with concrete about 40 per cent of the canals and laterals of the Okanogan irrigation project in Washington, seepage losses have been reduced from 51 to about 15 per cent of the total water received at the head works. The lining has been placed in the sections of

the canals where seepage losses were greatest, these localities having first been determined by current meter measurements.

The losses in the canal system for 1911 with 43 miles of canals and laterals in operation and only 1 mile concrete lined was 51.1 per cent, an average of 1.2 per cent per mile. The loss for 1915 was 20.4 per cent with 76 miles of canals and laterals in operation, or an average of 0.27 per cent per mile. It is estimated that the further lining for 5 ½ miles which will be completed before this year's (1916) irrigation season commences will reduce the losses to less than 15 per cent.

In the original designs most of the canals were built with 1 on 1 ½ slopes on the upper portions of the project and 1 on 2 side slopes on the lower or sandier portions. A friction factor of $n = 0.025$ was used for the unlined canals, while $n = 0.015$ was found to be safe for concrete lining. The canals as already built and in operation were generally too large for lining without back filling. A concrete lining 1 ½ inch thick was decided upon with a backfill of sand and gravel of at least 3 inches on the bottom and side slopes. According to the size of the canal in some places, the backfill required was 4 to 8 inches and sometimes as much as 2 feet.

The writer describes in detail the methods followed in carrying out the work. Altogether, 134 000 lineal feet of canal were lined and they required 7500 cu. yards of concrete.

The following table gives some data concerning the work done and its cost per cubic yard and per lineal foot.

| | Section A | Section B | Section C | Section D | Section E |
|---|---|---|---|---|---|
| Width of bottom, feet . . . . | 0.50 | 1.25 | 2.00 | 3.00 | 4.50 |
| Total depth " . . . . | 1.10 | 2.00 | 2.25 | 3.20 | 4.60 |
| Perimeter " . . . . | 5.45 | 7.93 | 11.10 | 15.52 | 22.06 |
| Cu. yds. concrete per 100 ft. of canal . . . . . | 2.52 | 3.65 | 5.15 | 7.15 | 10.20 |
| Cu. yds. backfill per 100 ft. of canal . . . . . | 5.00 | 7.5 | 12.00 | 38.00 | 28.00 |
| Lin. ft. per cu. yd. of concrete | 39.50 | 27.40 | 19.40 | 14.00 | 9.82 |
| Total cost per cu. yd. concrete and foundation . . . . . $ | 9.815 | 9.700 | 9.695 | 9.877 | 8.065 |
| Total cost per lin. ft. . . . . $ | 0.248 | 0.355 | 0.498 | 0.706 | 0.823 |

Part of the lining has been in use for four seasons and has given good service and shows no signs of wear. No trouble has been experienced on account of expansion or contraction injuring the lining even when the canal is dry during half the time in summer.

# RURAL ECONOMICS.

RURAL ECONOMICS

793 - **Increase of Yield of the Soil in the Alpine Regions of Salzburg, Austria.** — HAMZ. ERNST, in *Wiener Landwirtschaftliche Zeitschrift*, No. 52, pp. 407-409. Vienna, June 30, 191

In spite of the long-continued efforts of leading men to replace the out of-date sytem known as " Egartenwirtschaft " (1) by a rational cultivatio of the Alpine region, no noteworthy progress has hitherto been recorde in that direction. The " Landeskulturrat " of the Tyrol alone has take this very important question in hand.

The enormous value of intensive forage crop production is obviou if we consider that in Austria about 311 220 acres are cultivated on th " Egart " system, the yield of which might without any great difficult be doubled, and if we compare the yield of artificial grasslands, which i 80 to 100 or even 240 cwt of hay per acre, with that of the " Egart", whil is 16 to 64 cwt. We may remark that in this comparison no allowance i made for the fact that artificial grass-land produces a quality of forage in comparably superior to that of the "Egart ", which contains from 60 t 80 % of weeds or poor quality grass. Unless the population are continuall instructed and the question is handled and constantly kept under watc by competent authorities, and the necessary information supplied whenev required, that is to say, unless somebody thoroughly at home in this que tion both theoretically and practically, takes it up systematically, th money granted to the " Subventionswiesen " (subsidised grass-lands) wil in most cases be absolutely wasted.

Not only those parts of the country where " Egart " is practised ar very much behindhand, but also those where cultivation prevails. Ther are at present still fallow lands, for instance the " Flachgau " of Salzburg in Upper Austria and in various parts of Lower Austria, where triennia rotation is still carried on. As the small region of Salzburg presents thes two very distinct systems of cultivation, it is expedient to mention here th conditions of soil utilisation existing on present farms.

I. — Region known as the " Egart " Region (Pinzgau, Pongau, Lungau and Tännengau). — The most usual rotation is: grain crops, grain crops then 4 years " Egart "; or grain 3 time running, and 3 years" Egart " There is no reason to do away with this system ; it is sufficient to substi tute artificial grass-land for natural grassland. On his trial lands, whic were tilled and dressed after the usual manner of the country, the Autho nevertheless obtained yields equal or very close to those generall obtained. It is evident moreover that the yields undergo considerabl increase if more careful tillage is done and if the preceding crops ar better chosen.

(1) The " Egartenwirtschaft ", or " Egart " system, as practised in the mountain region of Austria, part of Bavaria, etc., consists in fallowing for a certain period, laying down to gras for the same period, and cereal growing for a further equal period. (*Ed.*)

There may be taken as an example the results obtained at the School of Agriculture of Oberhalm, Tannengau, and summed up in Table I.

TABLE I. — *Results obtained at the School of Agriculture of Oberhalm.*

A. — *Cost of bringing an acre of land under cultivation (excess expenses as compared with "Egart" system) — Cover crop: oats.*

| | £ s. d. |
|---|---|
| 1 days ploughing (cost of team 6*s.* 8*d.* per day) | 6. 8 |
| 1/4 day harrowing (at 6*s.* 8*d.* per day) | 1. 8 |
| 1/8 day to cover seeds mixture | 10 |
| 1/2 day to sow oats and seeds mixture | 1. 0 |
| 5 1/2 bushels of oats at 2*s.* 6*d.* per bushel | 14. 9 |
| | 1. 4. 11 |
| Mixture of clover and grasses | 1. 3. 4 |
| | 2. 8. 3 |

B. — *Yield of hay per acre in cwt. (valued at 2s. 6d. per cwt.).*

| | 1913 | | | 1914 | | |
|---|---|---|---|---|---|---|
| | cwt. | £ s. d. | per cent | cwt. | £ s. d. | per cent |
| Rotation grass land | 85.61 | 10. 14. 0 | 140.66 | 88.70 | 11. 2. 0 | 153 |
| "Egart" control | 59.73 | 7. 9. 0 | 100.00 | 57.84 | 7. 4. 6 | 100 |
| Increased yield | 25.88 | 3. 5. 0 | 40.66 | 30.86 | 3. 17. 6 | 53 |
| Cost of bringing under cultivation | | 2. 8. 3 | | | | |
| Net profit | | 16. 9 | | | | |

C. — *Composition of:*

| | | |
|---|---|---|
| Rotation grass land: | Green oats clover and improved grasses. | 18 % weeds and bad quality grass. |
| "Egart" control: | Clover and improved grasses. | 43 % weeds and bad grass in the hay.<br>51 % in the aftermath. |

In the regions where "Egart" is practised, and where grass grows heavily, the trials showed that starting cultivation with still green cereals is by far the most advantageous. The reasons are several :

1) This power of strong growth of the grass also influences the cereals, which develop powerfully and produce a large quantity of culm and leaves, throwing so much shade on the seed that its growth is very much impeded ;

2) These cereals lodge easily, which makes the result of sowing doubtful ;

3) It is impossible by tillage to secure anything like complete elimination of the weeds owing to the shallowness of the arable soil.

Besides this, when the fields are sown with ripening cereals, one half at least of such seed is lost. Starting cultivation with still green cereals means

some increase of labour, which is more than made up for by the very much superior quality of the forage. The estimate of starting expenses given above shows that the increased labour only amounts to 2 days' labour of one person per acre and just over 1 ¼ days of one team, and it only recurs every 6 years; evidently then this increased labour can hardly cause any difficulty.

II. — So-called Ploughing Region (Flachgau). — As an example clearly showing the increase of yield which may reasonably be expected, the results obtained on the farm of the peasant *Stadler* at Vollern near Oberndorf and summed up in Table II, may be adduced.

TABLE II. — *Results obtained on the Farm of the Peasant* STADLER *at Vollern near Oberndorf*

A. — *Costs per acre of putting under cultivation (excess of expenses over permanent natural grass land) — Cover crop: oats.*

| | £ s. d. |
|---|---|
| As previously . . . . . | 1. 4. 11 |
| Plus mixture of clover and grasses . . . . . | 1. 5. |
| Total expenses . . . | 2. 9. 11 |

B. — *Yield of hay per acre (valued at 2 s. 6 d. per cwt).*

| | 1913 | | | 1914 | | |
|---|---|---|---|---|---|---|
| | cwt. | £ s. d. | % | cwt. | £ s. d. | % |
| Artificial permanent grass land . | 47 | 5. 17. 6 | 171 | 71 | 8. 17. 6 | 168 |
| Natural permanent grass land . | 27 | 3. 7. 6 | 100 | 42 | 5. 5. | 100 |
| Increased yield . . . . . | 20 | 2. 10. 0 | 71 | 29 | 3. 12. 6 | 68 |

C. — *Starting cultivation with ripening oats.*

The expenses also amount to £2. 9. 11.

D. — *Yield per acre in cwt.*

| | 1913 | | | 1914 | |
|---|---|---|---|---|---|
| | cwt. | | £ s. d. | cwt. | £ s. d. |
| Starting cultivation . | Grain 12 (at 7. s. 7 d.) = | | 4. 11. 0 | Hay. . . 87 | 10. 17. 6 |
| | Straw 21 (at 2. s. 1 d.) = | | 2. 3. 9 | | |
| | Total . . . | | 6. 14. 9 | | |
| | Expenses to be deducted . . . | | 2. 9. 11 | | |
| | Net profit , . . . . . | | 4. 4. 10 (1) | | |
| Control plot, hay . . | 31.25 (2 s. 6 d. *per cwt*) = | | 3. 18. 0 | 57 | 7. 2. 6 |
| | | | | Net profit . . . 30 | 3. 15. 0 |

(1) Evidently therefore the seed and labour are paid for and the profit realised is enough to cover the loss of one hay crop.

In this particular case (and also perhaps all through the " Flachgau " where fallow land is maintained), the starting of cultivation with ripening cereals is preferable to cultivation with still green cereals ; on the other hand the quality of the forage is not quite so fine.

The most frequent rotation in the regions known as arable regions is : rye, oats (with clover sowing), clover, wheat, oats, fallow. " Egart " cultivations are however also met with, and also the different variants of the above example. Fallowing is an inherited trouble.

One must not reckon too much on the resulting increase of the productive power of the soil as it does not exceed that of a well manured field under some well cultivated crop or pulses. From this point of view, fallowing may still be adopted in special cases and by way of exception, but not as a cultural system. On several peasant farms the Author made a trial and replaced fallowing by a corresponding period of some cultivated crop and vetches and oats sown together ; the rye which followed was better in quality than that growing after fallow. For instance, on the farm of the peasant ENZENSBERGER, at Enzesberg near " Thalgau ", the trial of oats and vetches produced a crop of forage amounting to 140 cwt per acre, which is equivalent to 140 : 4 = 35 cwt of hay. In other places the yield was still higher : the farm of " Winkelhof ", for instance, obtained 208½ cwt of forage. Reckoned per labourer, fallowing required 5.5 days labour per acre, oats and vetches only 4.5.

According to the *Statistical Year-Book of the Imperial and Royal Ministry of Agriculture*, there are in the Salzburg region 70 994 acres producing only 23.5 cwt of hay per acre. Assuming, without any allowance for local deficiencies (defective ploughing, etc.), that by undertaking work on a large scale and reckoning only 30 % increase, a much higher result will be secured, there would then be obtained 7.07 cwt of hay per acre (30 % of 23.5 cwt) or, for the 70 994 acres 412 182 cwt of hay, or again (1 cwt being worth 2*s.* 6*d.*) £63 780, Deducting one-fourth, or £15 945 at the beginning of the year, to cover the expenses of starting, there remain £47 835. Furthermore, according to the report of the Imperial Royal Society of Agriculture at Salzburg, the total grass-land area in « Flachgau » is 45 515 acres; assuming that 50 % is made up of sour grass-land, there still remains 22 757 acres of permanent grass-land the yield of which may very well be increased 60 to 70 % as was shown by the example of the farm of Vollern. Reckoning on a production of 24 cwt per acre, the assumed increase of 30 % in the yield would represent 7.17 cwt per acre, making for 22 756 acres, 163 160 cwt of hay, worth (at 2 *s.* 6 *d.* per cwt) £20 345. Still according to the report of the same Society, there remain fallow in the " Flachgau " 4 386 acres. Taking as a basis the example of the Enzesberg farm, one would obtain 35 cwt × 4386 = 153 510 cwt of oats and vetch hay worth (at 2*s.* 6*d.* per cwt) £19 138. For the entire Salzburg region, this would mean an annual return of 815 563 cwt of hay. and, in round figures, a net profit in hay value of £83 750, and consequently a *great increase in the public wealth of Salzburg.*

## AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

794 - **Table Wines and Blending Wines of Sicily.** — MANCINI CAMILLO, in *Giornale vinicolo*. 42nd Year, No. 21, pp. 369-371. Casale Monferrato, May 21, 1916.

PROVINCE OF CATANIA. — This is the province in which wine-growing covers the largest area: 111 940 acres, producing on the average 6 875 000 bushels of wine, or more than half of the entire production of the island. In view of the special conditions created by Etna, where the vine extends up to more than 3 000 feet, the province of Catania produces very varied wines, from highly alcoholic to the lightest, chiefly red wines, though there are also excellent white wines.

Red Wines of Etna: 1) *Wines of the plain of Mascali* (Giarre Riposto and Acireale), blending wines, with distinct aroma, alcoholic and strongly coloured;

2) *Wines of the plain of Calatabiano* (Piedimonte Etneo, Fiumefreddo, Faggi, etc.), less alcoholic, aromatic, fairly agreeable, reserved chiefly for local consumption;

3) *Wines of Feudo*, produced in the Feudo plain; less coloured and less alcoholic, do not keep so well;

4) *Wines of the middle mountain zone*, grown on the slopes of Etna (Randazzo, Linguaglossa, Castiglione), of ruby colour shading to orange, good taste; agreeable aroma, medium alcohol content;

5) *High mountain wines*, grown on Etna at between 2 600 and 3 900 ft altitude; these are light and tart table wines.

White Wines: The southern slope of Etna (Viagrande Zafferana, Trecastagni, Pedasi, Nicolosi) produces good white wines. If allowed to mature by ageing, they constitute excellent table wines. The province of Catania also produces white wines of the Marsala type.

In 915 wines of this province analysed at the Royal Wine-making School of Catania, the alcohol content ranged from a minimum of 6° (Giarre) to a maximum of 14°.5 (Acireale).

PROVINCE OF PALERMO. — Possesses 55 600 acres of vines producing a little more than 22 million gallons of wine of every description, from the commonest to the finest table and blending, white, red and light red. The blending wines with a fine garnet-red colour are produced by "perricone" stock; when blended with the white "catarratto", the "perricone" gives fine red table wines. These stocks, with the system of "pesta imbotta" (1), give excellent light red wines. Some white wines of the Sauterne type, but warmer and more alcoholic, are also known abroad: the *Corvo* of the Duke of Salaparuta, the *Calattubo* and the *Zucco*. In

(1) According to the system known in Sicily as "pesta imbotta", the must, produced by treading the grape with the feet shod with nailed boots in masonry vats, is collected in "mastelli" (lower vats), from which it is conveyed to casks (which are filled $^4/_5$) to complete alcoholic fermentation. — Cf. Dr. Antonio Sannino, *Trattato completo di Enologia*, Vol. II p. 39. Conegliano, 1907. (*Ed.*)

95 wines of the province of Palermo, analysed at the above mentioned School, the alcohol content ranged from a minimum of 11°.6 (Santa Flavia) to a maximum of 18°.14 (Partinico).

PROVINCE OF MESSINA. — Although the vineyards here only occupy the coastal region, they nevertheless cover 51 400 acres and produce on the average more than 17 600 000 gallons. The most famous wine of the province is *Milazzo*, produced by the " Nocera " stock ; this is a much appreciated blending wine because it combines fairly strong acidity (6° to 10°) with colour and rich alcohol content (14° to 16°). The wines of Faro are also in high repute in the province. The Aeolian islands produce the famous *Malvasia di Lipari*, one of the finest white wines, containing from 13° to 15° of alcohol and from 17.28 to 27.20 ounces of dry extract per gallon.

PROVINCES OF GIRGENTI AND CALTANISSETTA. — The wine making industry is of no particular importance here.

More than half the Sicilian vineyards have been restocked with American wines.

795 - **The Wine of Grapes treated with Arsenates.** — TROFIMENKO M. and OBIEDOFF S in *Le Progrès agricole et viticole*, Year 33, No. 14, pp. 331-333. Montpellier, April 2, 1916.

By experiments recently carried out at the School of Agriculture of Montpellier (France), the writers show that in the control of the parasites of the vine, particularly *Conchylis ambiguella* and *Polychrosis botrana* of the second generation, arsenical salts embodied in wet mixtures are superior to all the other treatments tried. To allow of general application of these salts, however, there must be the certainty that the wine produced will not be poisonous.

Messrs. MOREAU and VINTE have already shown, by experiments carried out in the north-west of France, that these wines are not toxic. Nevertheless, as it may occur that in these parts the frequent rains wash all the mixture applied off the grapes, it was desired to repeat the experiments at Montpellier under the most favourable conditions for the continuance of the arsenical salts, both on the grapes and in the must.

The grapes had been treated late with wet arsenical mixtures ; no rain had occurred between the treatment and vintage ; the arsenical substance formed a *continuous* layer round the grapes, stalks, and stems.

The density and acidity of the must obtained from the grape subjected to different treatments (nicotine, arsenic, lime, water 65 %) and from the control grapes were practically the same. Wines obtained from grape treated with arsenic showed under analysis the following quantities of arsenious anhydride :

| Red Wine | Arsenic | White Wine | Arsenic |
|---|---|---|---|
| Wine . . . . . | Traces (0.0002 per litre). | Wine . . . . . | Nil |
| Lees (1st) . . . . | 0.001 gr per litre | Lees . . . . . | Traces |
| Lees (2nd) . . . . | Traces | | |
| Grounds . . . . . | 0.05 gr per kg of dried grounds. | | |

Although all the operations were conducted so as to ensure the best conditions for the arsenic to pass into the wine as much as possible (the floating skins were forced under regularly every morning; the must was stirred up; racking was delayed until the completion of fermentation); arsenic is therefore absolutely absent from white wine and only occurs in minute traces in he red wine. The latter tasted very good; the Authors consumed from 5 to 6 litres of it without the slightest sign of poisoning or indisposition occurring.

The lees may be used for extracting the tartar, washing being sufficient to remove the arsenates. The grounds cannot be used either as cattle or poultry food.

Other uses of the grounds are possible (manure, treatment of mildew, etc.)

The experiments will be continued.

796 – **The Determination of the Iodine Index of Alcoholic Liquids.** — MARCILLE R., in *Bulletin de la Direction Générale de l'Agriculture, du commerce et de la colonisation*, 20th Year, No. 86, pp. 18-28. Tunis, January, February 1916.

It is proposed to study the action of light during the determination of the iodine index in essential oils, this action being remarkable when the oil is dissolved in alcohol. This is a matter of practical importance, especially now that, apart from current requirements of the liquor trade, other reasons for these determinations have been created in consequence of the legislation as to the maximum content of essential oil in alcoholic liquors.

The Author sums up in a few tables the results of the determination of the iodine indices, in the dark room, with reduced light and in full day light, for some essential oils, as well as the influence of the alcohol content and length of contact, that of the temperature, the grade of the essential oil, its quality and age. The following are the final conclusions :

Among the essential oils studied, these of Aniseed and *Illicium anisatum* (Chinese Aniseed) alone show an increase in the iodine index through the action of light, and this property may be used to characterise them. Any mixture of essential oils which exhibits in light an iodine index above that obtained in the dark room, will contain oil of aniseed or oil of *Illicium anisatum*. Oil of peppermint is distinguished from menthol by the fact that the former has a remarkable iodine index, while that of the latter is nil. Thus even the ratio of mixture in flavoured products might be determined. The determination of the iodine index of essential oils requires the following precautions : the use of a uniform volume of alcoholic solution of the same strength in all the tests (100 cc. of solution at 50°), the addition of the chloro-iodo-mercuric solution (30 cc.) in a dark room and keeping the bottle in the dark during contact; taking care that all solutions should be of the temperature of the surrounding air. For accurate determinations, the tests with a standard essential oil preparation should always be carried out at the same time.

797 - ***Pectinobacter amylophilum*, a New Organism which may be of Practical Importance in Flax Retting.** — MACRINOV J. A. (Sur un nouveau microrganisme provoquant la fermentation de l'amidon et des substances pectiques), in *Archives des Sciences biologiques*, published by the Imperial Institute of Experimental Medicine in Petrograd (French edition), Vol. XVIII, No. 5, pp. 440-452, 8 fig. Petrograd, 1915.

When carrying out bacteriological analysis of a sample of soil, a new micro-organism was isolated the behaviour of which in the presence of starch attracted attention. In contrast to other micro-organisms which have the power of decomposing starch but prefer sugar, this one prefers starch to sugar.

The researches were conducted at the Laboratory of the Section of General Microbiology in the Imperial Institute of Experimental Medicine of Petrograd. Here the behaviour of the new bacterium was studied in relation to the fermentation of sugar, starch and many other carbohydrates, pectic substances, nitrogenous substances, and cellulose, and also the products of its vital activity in a suitable environment.

The name of *Pectinobacter amylophilum* corresponds to the biochemical properties of the new bacterium. The name of the genus, *Pectinobacter*, indicates its property of acting on the pectic substances ; and as to the name of the species, *amylophilum*, it points to its tendency to use starch exclusively as carbohydrate food.

*Pectinobacter amylophilum* is rod-like, somewhat swollen towards the centre, from 4 to 6μ in length, with a diameter of 0.5 to 1μ. It is mobile, and in fresh cultures has a spiral movement. Before sporulation, the bacterium assumes a spindle-shaped appearance, and the spores, elliptic in shape, are born in the widest part of the rod. When the vegetative parts of the bacterial cell are destroyed, the spores are set at liberty, and, if the medium is favourable, their development begins.

CONCLUSIONS : 1) *Pectinobacter amylophilum* is the specific agent of the fermentation of starch and pectic substances. It also acts on the products of hydrolysis of starch, although it has an evident preference for the latter.

2) Owing to its property of acting energetically on the pectic substances in an aerobic environment, the new microbe may be of great practical importance in flax retting.

The behaviour of this microbe in relation to pectic substances has been studied in the process of flax retting, in aerobic, anaerobic, and mixed environments. In the first case, the flax stalks, bound into bundles, were heated in pure water. In this way a large quantity of organic substance was extracted. The liquid was thrown away and the bundles sterilised in some more water. After inoculating with bacteria, the bundles were placed in a thermostat at a temperature between 30 and 45° C. After 8 to 10 days, retting was complete. The fibres as well as the boon separated easily. It is found from experiments with the fibre that it is of good quality and considerable strength, although fine and delicate. It keeps whole and does not break up into shreds. The yield of the flax in the shape of fibre and tow is an excellent one with this treatment. Investigations are being continued.

The retting in an anaerobic medium was carried out in wide tall glass

cylinders filled with water to the brim, the whole length of the flax bundles being put into the cylinders. Sometimes, in order to have a real anaerobic environment, small bundles of flax stalks were put into small test tubes, and the air pumped out. The experiments showed that the action of the microbe in an anaerobic environment is insignificant. In a mixed environment (intermediate between aerobic and anaerobic) the work of the bacterium is less active than under purely aerobic conditions, and more intense than under anaerobic conditions.

(3) The new bacterium, which has the power of acting on starch and destroying the vegetable tissues, should play an important part in the destruction of the vegetable masses falling on the soil.

798 – **New Method of Flax Retting Invented at the Technological Institute of Petrograd.** — See No. 753 of this *Bulletin*.

799 – **Hats made of Chinese Palm Leaf.** — CHIERI C., in *l'Agricoltura Coloniale*, Year X 1st Half-Year, No. 4, pp. 187-189. Florence, April 30, 1916.

A new Chinese industry is here described, namely, the manufacture of hats from the leaves of a palm tree not yet identified botanically and which the Chinese name merely describes as Tung-shu (palm plant).

This palm tree is said to be one of the varieties of *Chamaerops fortunei*.

The leaves for hat manufacture are gathered at Kwanksien, a few miles from Chêugtu, a hilly part of the country, where the plant grows wild in large numbers, thriving in the rather poor and moist soil. The tree presents different varieties, some specimens reaching a height of 6 feet. For hat-making, however, the leaves of the small, young plants are used as they are more fibrous and flexible, and narrower. The leaves are imported into Chêugtu and are there cut up into long strips of uniform width. From each leaf 100, 110 or up to 120 strips are cut, according to the quality of the hat and the flexibility of the leaf. The cut strips are boiled in water and steeped in a special bath, from which they emerge light yellow in colour. On drying by exposure to the air the colour turns to pearl. For a hat of the finest quality, 16 leaves, *i. e.* about 1750 strips are required, while an ordinary hat requires an average of 1100. The hat is begun and finished by the same workman, and is afterwards washed in an acid solution of secret composition and is next hammered, if desired. Hammering, which is carried out by specialised workmen with polished round stones, is a difficult operation which imparts to the hat a particularly brilliant gloss of very pleasing effect.

The best hats turned out by this new Chinese industry, which is barely a year old, are fully equal to genuine panamas. They are in such demand in the home market that it is intended to double the number of workmen. enquiries from abroad are also beginning to come in.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

800 – **The Cheese Industry in Portugal.** — RAMIRES BAPTISTA ADOLPHO, in *Broteria, Serie de Vulgarizacão Scientifica*, Vol. XIV, Part III, pp. 156-164. Braga, May 1916.

The cheeses manufactured in Portugal proper are of different types named according to the locality or region of production. They are gener

ally small, being from 1.1 to 4.4 lbs. each, or in rare cases 4.4 to 6.6 lbs.

Among the oldest kinds manufactured, the chief are : 1) " Serra da Estrella " and its varieties " do Alemtejo " and " de Azeitâ " ; 2) " Castello Branco " ; 3) " do Rabaçal ". All of them are made from ewes' milk except " Castello Branco ", which is made from goats' milk or goats' and ewes' milk mixed, and they are all soft cheeses. The best is the Serra, which, if well prepared, will compare with any foreign cheese made from ewes' milk. Besides these, however, there are a large number of very different descriptions of cheese of local manufacture and consumption, among which there are mentioned : " saloio " made with cows' milk in the neighbourhood of Lisbon, and eaten fresh ; the hard goats' milk cheese of Beira-bassa ; and the small cheeses of Serpa weighing from 2.4 to 3.5 ounces and of very delicate flavour. During the last few years two new descriptions worth mentioning have appeared on the market, the only hard cheeses manufactured in Portugal : one is an imitation of " Caerphilly ", and the other is known under the name of " Cardiga ". Imitations (generally good) of Camembert, Edam and Gouda are also made.

In the Azores, where cheese-making is on an industrial scale, the hard cheeses " Pico ", " San Jorge " and " Terceira " (so-called from the name of the islands where chiefly produced) have been manufactured for a long time almost exclusively from cows' milk. From the island of San Miguel the cheese industry has long since disappeared, butter-making having completely taken its place. The cheeses produced in the Azores are held in great esteem in Portugal. They weigh from 11 to 33 lbs. each, and sometimes, though less frequently, 44 to 66 lbs.

In Madeira, cheese-making is in process of development. Fairly successful imitation of the Edam, Gouda and Cheddar cheeses are turned out, skim milk, produced in large quantities by the butter industry, being partly utilised.

Among the cheeses made in Portugal proper, the Serra fetches the highest price (from 45 to 60 centavos, i. e. 11d. to 1s. 3d. per lb.) The Alemtejo is hardly any cheaper, but the island cheeses are a little lower in price ; the minimum market value to which they sometimes drop is 30 centavos, or 7 ¼ d. per lb.

In Portugal, the total annual production of cheese has been calculated to amount to 6 210 tons, being 5 560 tons for Portugal proper and 650 tons for the Azores. These figures do not include Madeira. The quantity manufactured from ewes' milk is estimated at 3 000 tons, that from mixed ewes' and goats' milk at 1 100 tons, that made from goats' milk at 1 200 tons and that from cows' milk at 910 tons.

In continental Portugal cheese-making is chiefly a home industry, carried on with primitive implements and on primitive methods. For curdling, the rennet of the kid is sometimes used, but mostly the dried flowers of *Cinara Cardunculus*. There are, however, some large factories equipped with up-to-date plant ; these turn out almost all the cheese manufactured in the islands.

The manufacture of imitations of foreign cheeses, chiefly as an ad-

junct to the butter industry, was encouraged a few years ago by the district agricultural experiment Farms ("Quintas districtaes") and afterwards by the Schools of agriculture, especially those of Santarem and Coimbra.

The chief defect in the cheeses produced in Portugal proper is their lack of standard quality. As to the quantity produced, it is only limited by the milk available, there being a sure market for the entire output. The excessive number of very small farms with little livestock makes it difficult to improve the cheese industry. In the Serra da Estrella, where sheep and goats are most productive, each female, during the lactation period, furnishes 8.8 to 9.8 galls. of milk beyond what is required for rearing, which is a comparatively good output. The flocks, however, are very small, rarely numbering more than 200 head. Mostly they consist of 100 and even less. Here and in Central Beira, the milk production is of equal importance with wool production. In the Alemtejo, milk production is secondary in importance to wool, meat and tallow. Though in this latter province the flocks are larger, this is set off by the low figure of production, which sometimes is only 2.2 galls per head above the rearing requirements.

AGRICULTURAL PRODUCTS : PRESERVING, PACKING, TRANSPORT, TRADE

801 - **The Measures to be adopted for Preventing Unfair Competition in the Cheese Trade.** — BÄRTSCHI J. and HALDEMANN M. (President and Secretary of the Swiss Union of Cheese Exporters). *Fédération Internationale de Laiterie, VIème Congrès International de Laiterie à Berne*, 8 *au* 10 *Juin* 1914, IVth Section, 8th Question, Report No. 3, pp. 1-3.

The writers put forward the following proposals, the carrying out of which may assist in combating unfair competition.

1. Constant work subsidised by the State, with the object of improving the quality of milk and dairy products (keeping powers, fat content, etc), *i. e.*:

(*a*) Directions as to fattening, treatment and feeding of dairy cows (return to nature) ;

(*b*) Instructions as to milking (the utmost cleanliness in milking and handling the milk) ;

(*c*) Strict observance of existing laws (law on the trade in food products, special enactments and regulations) ;

(*d*) better technical training for manufacturers (cheese makers), as, if the goods will not keep, they have to be sold at any price, and the fluctuations are in that case ruinous.

The importance of milk and dairy products in human food alone justifies these measures, apart from the enormous value involved.

2. Establishment of international standards for a uniform method of judgment and analysis of cheese, which would allow for present commercial practices and training of specialist experts whose opinion would be decisive in disputes.

3. More intensive joint work between co-operative organisation, Chambers of Commerce and the authorities.

4. Thorough systematic propaganda for the increased consumption of cheese as a healthy food for the people.

802 - **Changes occurring in Potatoes during Storage.** — See No. 743 of this *Bulletin*.

# PLANT DISEASES

## DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

803 – **Gummosis in the Citrus Plantations of Florida.** — STEVENS H. E. in *University of Florida, Agricultural Experiment Station, Report for the Fiscal Year ending June 30th*, 1914, pp. 57-71. Tallahassee, Fla., 1915.

Gummosis is common in the citrus plantations of Florida, causing greater damage year by year, especially in the north. Among citrus trees, C. Aurantium amara alone appears exempt.

Very little is known as to the origin and cause of this disease. It is certain that its development is influenced by several factors, and although many species of fungi are associated with gummosis, none of them can be regarded as the true pathogenic agent.

With the object of making a contribution to the study of this interesting question, the writer undertook a series of researches and experiments and a very careful investigation into the course of development of the infested areas. Several inoculation trials were made, both with crude diseased material and with pure cultures of *Diplodia natalensis* and *Phomopsis Citri*.

The 18 infested areas studied for a period of 13 months were selected so as to represent as closely as possible the different stages of development of the disease.

Three stages are distinguished : 1) the tissues seem impregnated with water over small portions of the bark ; small lesions and a few cracks appear from which a slight amount of gum exudes ;

2) The secretion of gum increases, the bark tissue hardens and cracks all over ;

3) Below the diseased part, the cambium forms a new parenchyma, and the diseased portions are ultimately completely eliminated, leaving a dry rough scar.

The first observations were made in May 1913 and afterwards repeated at intervals of three, ten and thirteen months.

Of the eighteen infected areas examined at the time the observations were begun, eight appeared already cured, while in the ten others the infection was in full course of development. Five of these latter always continued active, two recovered and then became active again, and finally three seemed fully healed at the end of the thirteenth month.

With regard to the eight other areas, healthy in appearance, four remained so for some time, in two the disease became active for some length of time, and the last two, with the disease in active progress, continued in this condition with extensive mortification of the tissues and abundant secretion of gum.

As will be seen, the development of the disease is very slow, with alternating active and passive phases, which may be related to variations in the degree of resistance of the plant attacked. When healing takes place, the whole of the infection has not been eliminated through the tissues of the host, but the pathological process appears to be arrested, perhaps owing to the formation of new tissues which react with more intensity against the disease. This is the period of greatest resistance of the plant. Afterwards the continuation of the attacks, excessive production of fruit, and other factors also, weaken and exhaust the plant, lowering its resisting powers so that the infected area reverts to the active stage, and the disease spreads to the surrounding tissues.

The writer also carried out inoculation experiments with diseased tissue with cultures of *Diplodia natalensis* and with cultures of *Phomopsis Citri* both on young orange trees in pots and on adult plantation trees. No definite conclusions can be drawn from the results obtained, as it was not possible in any case to produce the formation of the characteristic infected areas. In the adult trees there was, it is true, a slight secretion of gum, with partial mortification of the tissues, but it was only for a very short time and over very limited extents of the bark. The results are still more negative in relation to young plants, which are undoubtedly endowed with a higher degree of resistance.

In the control experiments the best results were obtained by means of cupric paste and carbolineum :

(1) Cupric paste : solution of sulphate of copper and milk of lime in equal parts ; mix thoroughly, then add lime until the mixture acquires a certain consistency. The infected areas were cured in the proportion of 64 %.

(2) Carbolineum diluted in soap water : cures 60 %.

Before applying the antiseptic, it is necessary to cut away unstintingly all the infected wood and the adjacent parts, and not to confine oneself to simply scraping and removal of the bark, as is usually done in the majority of cases.

804 – **Citrus Barkrot in the Philippines.** — ZERBST G. H. in *The Philippine Agricultural Review*, Vol. VIII, No. 2, pp. 95-97, Manilla, 1915.

The appearance of the disease known as " citrus barkrot " has caused serious injury to the cultivation of citrus trees in the province of Batangas, Philippine Islands. This disease having broken out with special severity

after the eruption of the Taal volcano in January, 1911, many growers believed that the eruption, which defoliated the trees, is responsible for the outbreak.

The mandarin (*Citrus nobilis* Lour.) appears extremely susceptible to the disease. The "calamondin" (*C. mitis* Blanco) is also attacked, but with much less severity. The sweet orange (*C. Aurantium* L.) and the pomelo (*C. decumana* L.) are much more resistant than the mandarin to barkrot, being seldom attacked to a serious degree.

Barkrot has much in common with gummosis, with the difference that the disease is an exudation of sap instead of gum, and that young trees and seedlings are immune. The characteristic of barkrot in which it is similar to gummosis is that in some cases badly infected trees mature their fruit prematurely, the fruit showing a bright yellow colour while still very small. This is particularly noticeable in the mandarin, which usually does not colour well in the Philippines.

The disease makes its presence known by the oozing out of sap from the bark, which softens and forms a putrid sore, varying in size from one-half to 3 $^1/_2$ centimetres on the trunk and branches, generally at the height of $^1/_2$ to 1 $^1/_2$ metres from the ground, though the disease occurs as high as 3 to 4 metres on the larger branches. Where the outbreak is severe these spots occur thickly and finally unite, with the result that the tree or branch is quickly girdled. Numbers of insects are attracted to the sores by the putrid sap, and the spots are usually found to be infected with the larvae of various insects which keep up the irritation. As the tree strives to overcome the disease, the spots dry up, the edges of the sores begin to heal over, and the bark curls or scales. On brushing off the dead bark the new wood is seen forming on the edges of the sores, giving to badly affected branches a queer distorted appearance.

The term "barkrot" is to some extent misleading, as the disease does not originate in the bark. If the bark and cambium layer are cut away and the underlying wood carefully examined, a dark-coloured area, usually of a brown to a reddish tinge, is found. This extends into the wood to different depths. As in gummosis, the sap collects in small pockets between the wood and cambium layer until the bark is separated from the wood and finally split by the pressure within, so that the sap oozes out.

The Philippine Bureau of Science has carried on investigations on barkrot, but failed to find an organism to which the disease might be attributed. Apparently it is a physiological disease produced by unfavourable soil and cultural conditions. The irregularity of the water supply is also a factor.

Proper ploughing and cultivation varying in depth each year, and the planting of leguminous cover crops during the rainy season, are apparently essential in the prevention and cure of barkrot. The cover crop should be cut and left as a mulch during the dry season. The treatment of the tree itself is a matter of secondary importance.

The earth round the tree should be thoroughly loosened and stirred.

The diseased spots should be cut out down to the healthy wood, at once

painting the wound with a protective material. The Philippine Bureau of Agriculture has worked satisfactorily along the above lines, obtaining improvement which leaves little to be desired under this treatment.

805 – **" Parch Blight " on Douglas Fir in Oregon.** — MUNGER THORNTON T. in *The Plant World*, Vol. 19, No. 2, pp. 46-47. Baltimore, Md. February 1916.

Quite frequently, in the spring of the year, the foliage of the Douglas fir trees in the vicinity of Portland, Oregon, turns brown, and entire trees are sometimes as sere as though recently dead or dying. With the beginning of the growing season, however, most of the buds open normally, and by midsummer the trees have regained their usual green appearance, many of the old needles dropping off.

The injury is generally limited to temporary inhibition of growth, with a slight loss of timber production. Isolated trees are more liable generally to the disease than dense groves. Exposed eastern sides of forest are more affected than the western sides in protected locations.

The blight is due to the dry east winds that occasionally sweep across the Cascade Mountains, the vicinity of Portland being particularly exposed to the direct sweep of these winds down the canyon of the Columbia river.

The Douglas fir (*Pseudotsuga Douglasii*) in this region is called the Coast form, and is particularly dependent upon a humid, mild climate, and consequently suffers from these hot, dry blasts, which cause excessive transpiration and produce the above injuries.

806 – **Fruit Injury during the Fumigation of Citrus Trees: Causes and Remedies** (1). — WOGLUM R. S. in *The Fruit World of Australasia*, Vol. XVII, No. 3, pp. 70-72. Melbourne, March 1st, 1916.

The production of citrus fruits in Australia amounted in 1913-1914 to 1,341,878 bushels of oranges of the value of £ 497,286, while that of lemons was 297,083 bushels valued at £ 97, 753. The problem of protecting citrus trees against their enemies therefore is of great importance. The method of control most in use is that of fumigation with hydrocyanic acid, a very effective system, but one which sometimes pits the fruits. The writer proposed to investigate methods of avoiding such injury. The pitting of fruit caused by hydrocyanic acid fumigation has been put down by specialists to various causes, such as sulphuric acid, the presence of nitric acid in the sulphuric acid, the too rapid evolution of the gas, the absorption of the gas by the water on the tree, an abrasion of the fruit produced by the tent placed over the tree, etc. The impurities contained in the two reagents used, however, potassium cyanide and sulphuric acid, are in such small quantities that they cannot produce any marked effect. On the other hand there can be no question of the pitting being caused by minute drops of sulphuric acid thrown off in the over-rapid evolution of the hydrocyanic acid, as in that case the injury would only affect the fruits placed lowest and in the immediate vicinity of the generator. The most seriously injured fruits, however, are those at the top, and sometimes they are the only ones

(1) See also *B.* June 1911, No. 1967. (*Ed.*)

injured. If fumigation is carried out before sunset the pitting is sometimes only found on the sunward side. Finally, if instead of sulphuric acid phosphoric acid, which is stable and has a very slow reaction is used, the extent of pitting is not in the least reduced nor, as the author ascertained experimentally, is it reduced when chemically pure hydrocyanic acid is employed. It may therefore be concluded with certainty that the pitting is caused by hydrocyanic acid and by no other cause. It depends : (1) on the quantity of gas used and the length of fumigation ; (2) on the condition of the plants treated ; (3) on atmospheric conditions.

Generally speaking, a plant weakened by gummosis, for instance, sustains more injury than a vigorous one. The pitting is more severe in fruits with thin skin, especially if the latter has recent abrasions. The Author found that on fruits pricked with a fine needle, then subjected to fumigation with chemically pure hydrocyanic acid, a depressed pitted zone always formed round the prick. Consequently the bulk of the injury arises from lesions occasioned during the pulling over of the tents.

The pitting is much more severe when fumigation is carried out : 1) during hot sunny days ; 2) when the temperature is near 32° Fahr ; 3) during exceptionally hot nights ; 4) when a strong wind blows and shakes the tents ; 5) during very wet nights.

Excessive moisture in itself occasions more injury than all the other factors together, precisely because it renders the tents more impermeable to gas and heavier, which increases the injury already sustained by the trees when they were pulled over.

The bulk of the injury therefore may be avoided by taking the following precautions : preventing the tents striking the trees as far as possible ; using poles higher than the trees to support the tents ; stopping the fumigation when the tents are heavy with wet or when the trees are wet ; carrying out no fumigation during over-hot days, or when windy, or when the temperature is too low (the author advises adopting 36° F. as the minimum temperature).

Trees sprayed with Bordeaux mixture may not be fumigated until a year later. Failure to observe this rule causes exfoliation. The Author never found any injury follow from fumigation following treatment with ime and sulphur solution.

## DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

807 – **On the Original Range of *Spongospora subterranea*.** — Lyman G. R. and Rogers I. E. in *Science*, New Series, Vol. XLII, No. 1096, pp. 940-941. Lancaster, Pa., 1916. GENERALITIES

The discovery of *Spongospora subterranea* by the Department of Agriculture of the United States on potatoes from Peru throws some light on the still unsettled question of the place of origin of this parasite. It is very widespread in Europe, and during the last three or four years has also

appeared in several parts of the United States (1) and Canada, causing extensive damage.

As was shown by the work of KUNKEL, the union between the plant host and the parasite is an extremely intimate one, which proves that the form of parasitism under consideration is of very ancient date.

The disease never assumes acute form, the destruction of the tissues being neither rapid nor complete, but the process of infiltration and destruction is slow, and a comparatively long time is required to overcome the resistance of the plant.

Specimens of the parasite were discovered by LAGERHEIM at Quito (Ecuador) in 1891. It was not stated, however, whether the disease was endemic or whether it came from Europe, where it has been known since 1841.

In the present case the potatoes were native to Peru, coming from the eastern slope of the Andes, the regions of Cuzco and Ollantayatambo at about 10,000 ft. altitude. Some of the infected tubers were even supplied direct by the Indians residing in a locality lying between the valleys of the Umbamba and the Lucumayo near the Panticalla Pass, at 12,000 ft, almost at the limit of potato cultivation. The presence of European materials in these isolated and remote spots must be set aside a *priori* : therefore host and parasite would be indigenous to Peru. This hypothesis is further borne out by another fact : the spores which develop on the Peruvian varieties are much smaller than those found on the European and North American tubers. Generally the disease is much less severe, so much so that the natives pay no attention to it. In the course of time the host appears to acquire a power of resistance which counterbalances the pathogenic action of the *Spongospora*.

Thus two reasons suggest that South America, the place of origin of the potato, also gave birth to *S. subterranea*.

808 – **Changes in the Chemical Composition of Rye Seed due to the Action of Certain Forms of *Fusarium*.** — See No. 742 of this *Bulletin*.

RESISTANT PLANTS

809 – **Experiments on Smut-resisting Powers of Different Varieties of Wheat.** — VON KIRCHNER O. in *Zeitschrift für Pflanzenkrankheiten*, Year 1916, Vol. 26, No. 1, pp. 17-25. Stuttgart, April 22, 1916.

The writer has, since 1903, carried on cultivation experiments at Hohenheim, Germany, with 360 wheat varieties (241 winter and 119 summer varieties) for the purpose of studying their resistance to smut (*Tilletia tritici*). The varieties in question are common wheat (*Triticum vulgare*), dwarf wheat (*T. compactum*), rivet wheat (*T. turgidum*), hard wheat (*T. durum*), Polish wheat (*T. polonicum*), spelt (*T. Spelta*). two-grain wheat (*T. dicoccum*), and one-grain wheat (*T. monococcum*). The seed was brought into contact with fresh fungal spores, and sown on the same day with equal areas for each variety ; the young plants were afterwards all given the same care and at the end of the experiment the number and percentage of diseased ears in all the varieties were determined. The majority of the varieties proved

(1) See *B.* February 1916, No. 246. (*Ed.*)

so prone to the disease in the very first experiment that there was no necessity to test them again; others, showing greater resistance were re-tested two or more times.

It was found that there are only a few varieties possessing great resistance to the disease. Such are chiefly the winter wheats, including the dwarf and rivet wheats.

Among the 194 varieties of winter wheat studied, those belonging to the group *velutinum* Schübl. are the most resistant, namely: « Hohenheim No. 77 " which was attacked 4 times during an experimental period of 10 years, " Fürst Hatzfeld " and also " Fürst Hatzfeld de Cimbal ".

Among the winter spelt varieties there were 3 blue ones belonging to the group *Alefildii* Körn. characterised by great resistance, namely " blue winter spelt with large square ear ", " hairy blue spelt with loose square ear ", and " hairy blue spelt with large square compact ear ".

Summer wheat is slightly more resistant. Mention must be made especially among the 71 varieties of common autumn wheat tested, of the Galician varieties with large square ear, although they behaved somewhat diversely in the different years of experiment. " Red Schlaustedt wheat " and a wheat obtained by pedigree crossing of the varieties " Bohemian Wechselweizen " × " Richelle white early " gave a like result. The most resistant variety was the " beardless Odessa ", which, being tested six times, on one occasion showed 0.56 % and on another 2.5 % of diseased ears.

Among the rivet wheats, the variety " smooth miracle red " which was tested 4 years in succession was entirely free from the disease.

The hard wheats were difficult to infect. Two of them especially are highly resistant, the " white hard smooth wheat with white awn " and the " white hard smooth wheat with black awn ".

Among the Polish wheats which were also difficult to infect, mention is made of the " large ear wheat " and " black awn wheat ".

Among the 5 varieties of spelt wheat which were generally fairly immune, there were 2 blue ones which up to now never contracted the disease.

" The red summer one-grain wheat " was difficult to infect. In 8 experiments the " red hairy summer one-grain wheat " once had no spores and on another occasion had 0.77 % of diseased ears.

The writer then mentions some varieties of winter wheat particularly prone to the disease. They are: " Strube's hybrid No. 26 " with 62.47 %, " Strube's hybrid No. 210 " with 62.98 %, " Buhleudorf wheat with Sperling brown grain " with 64.5 % and " Heines Teverson " with 85.77 % of diseased ears.

The least resistant summer wheats were: " Green mountain " with 24.2 % and " Rimpau red Schlanstedt " with 45.4 % of infected ears.

" White winter bearded spelt " had 44.87 % and the " two-grained winter white semi-awned " had 85.92 % of diseased ears.

Between the high susceptibility and low susceptibility groups are the other varieties tested. It is certain, therefore, that in addition to the varieties fairly or highly prone to the disease, there are others which rarely or

never contract it. These differences might perhaps be still more clearly shown if pure lines were used for experiment, which was not the case here.

These experiments have also proved that among some descriptions of one and the same variety of wheat, a certain agreement is found as regards their resisting powers to smut, but that this is not observed in the most important cultivated forms (ordinary and spelt). The experiments made with common wheat and spelt generally showed that when a wheat is resistant to smut, another belonging to the same botanical group does not necessarily behave in the same way. The degree of predisposition must rather be regarded as a character typical of the wheat under examination.

The author also endeavoured, by infection tests, to study the influence of external factors on the result of contamination with spores of the parasite. Even in the case of wheats which were regarded as prone to the disease the figures obtained in the different years for the same wheat differed greatly, sometimes falling to zero. It follows that the fact that an artificially infected wheat has not contracted the disease does not necessarily mean that it is refractory to it.

The great influence of external factors on the result of infection partly explains the contradictory observations made, especially by farmers, with regard to the smut-resisting powers of different wheats. In well-conducted experiments, however, a fair agreement of the different wheats is nevertheless observed. For instance, out of 17 wheats studied by the author and afterwards also tested by TUBEUF and HECKE, the same wheats were found prone or resistant to smut in all the investigations. The writer concludes that HECKE'S opinion that resistance to the disease is in each wheat a constant character influenced by other factors is correct.

Assuming that the degree of resistance is a constant character of the wheat, it must be concluded that this character is hereditary. No such experiments as were undertaken for " rust " have as yet been carried out, to determine whether susceptibility to the disease is hereditary. The writer does not think that the observations relating to rust can be extended to smut.

Without taking into account the question of heredity, the attempt has already been made to clear up the matter of the greater or lesser resistance of certain wheats to smut. TUBEUF suggested that a relation might exist between resistance to smut and the rapidity of the germination of the wheat grains, those wheats which germinate rapidly being the more resistant. This opinion is also supported by APPEL and GASSNER, who claim to have actually found such a relation. The writer's experiments nevertheless have shown that these results do not admit of generalisation and that at any rate this relation does not exist in a large number of common wheats, hard wheats, winter and summer spelts. HECKE obtained the same result. Nor is there any relation between the germinating capacity and the smut resistance, as was proved by the writer.

The difference in smut-resistance is thought by the writer to be due rather to differences in the chemical composition of the plantlets. The observations in respect to various diseases (rust, mildew, etc.), showing that the

most resistant wheats have a different chemical composition from those of low resistance, speak in favour of this hypothesis.

In order to test this hypothesis, the author studied the acid content of wheats differing clearly in their smut resistance. These were young plants of the " Richmond giant wheat " (highly liable to the disease) and " Fürst Hatzfeld " (highly resistant) which are morphologically identical. It was found that the resistant plants contained more acid than the susceptible ones. The absolute difference is small, but deserves to be pointed out, especially as the morphological characters of the conditions of growth of the two plantlets were the same. It may therefore be concluded from this experiment that there is a relation between the acid content and the resistance to smut.

810 - **Variations in the Resistance of Vines to Mildew.** — RAVAZ L. and OBIEDOFF S. in *Le Progrès agricole et viticole*, 33rd Year, No. 19, pp. 441-447, Fig. 1-6. Montpellier, May 7, 1915.

Though common to all vine varieties, the disease varies considerably in intensity according to the variety. What is the cause of this difference of behaviour ?

It is well known that the stomata are the only channel through which the hyphae of the parasite can enter. The writers, by a large number of experiments, determined exactly the average number of stomata per unit of surface of the leaf stems and petals of many kinds of vines, both French and American, without discovering any relation between the degree of resistance to mildew and the number of stomata. In any case the ratio would if anything be inverse, as there is a relatively larger number of stomata on the corresponding parts of American vines which are well known to have a high degree of resistance, while French vines, very liable to the disease, have fewer stomata.

The degree of attack of the vines is to be explained rather by the more or less early character of the types, and also the time when infection becomes apparent. When the leaf stems are very soft and herbaceous and still in process of growth the disease develops rapidly, causing the axes of the inflorescences to droop and partial rot of the tissues. Later on, on the other hand, when the leaf stems are partially lignified they become highly resistant. The fungus develops for preference on the young organs or on those in course of growth, as for instance on newly formed flowers and grapes.

811 - **Morphology and Conditions of Development of the "Sclerotium Disease of Clover" (*Sclerotinia trifoliorum*).** — PEGLION VITTORIO in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, 5th Series, Vol. XXV, 1st Half-Year, Part 7, pp. 521-524. Rome, April 2, 1916.



Among other questions in connection with *Sclerotinia trifoliorum*, which causes considerable damage to clover fields, especially in northern Europe, no solution has yet been reached with regard to those concerning the conidial or micro-conidial stage of this fungus and the conditions causing the epidemic outbreak of the disease in clover fields. The writer undertook the study of *S. trifoliorum* in order to solve these problems.

On a small plot under white clover (*Trifolium repens*) destroyed by this parasite, it was found that from the many sclerotia remaining flush with the ground, owing to break-up of the neck and stalks of clover, innumerable apothecia began to grow towards the end of October, and continued to appear in the first fortnight of November.

On placing a few ripe apothecia in Petri dishes the spores are found to be scattered in small heaps a few hours later. Each of these heaps is made up of the 8 spores contained in each ascus. As soon as disseminated the ascospores are ready to germinate, both in distilled water and in ordinary nutrient media. *Scl. trifoliorum* is psychrophile. At a relatively low temperature (8° to 10° C.) it rapidly penetrates the entire mass of medium, and in a short time gives rise to many sclerotia. The fragments of mycelium serve perfectly well for transplantation of the fungus in the pure state.

In spreading fragments of mycelium from pure gelatine cultures or potted earth sown with common forage pulses (clover, lucerne, fenugreek) the young plants are rapidly destroyed in proportion as they grow. *Scl. trifoliorum* forms a sort of inconspicuous network or spider's web, which spreads on the surface of the soil, surrounds the base of the young stalk and causes its disintegration. The young plants lodge, and in a few days time the differentiation of the conidiophores is seen to take place on them. The young plants are liable to infection during the entire germinating phase. As soon as the first leaves have formed, the receptivity appears to cease.

This fungus may also attack the bean, causing a disease with the same characteristics as that attributed to *Scl. libertiana*. The author concludes from the results of experimental infections that the injuries attributed to the latter are also sometimes caused by *Scl. trifoliorum*.

Trial was made of several means of causing the germination of the sporidia springing from the mycelium, but in this as in previous experiments the results were negative.

During years taking a regular course and in which grass crops are at rest before frosts supervene, the "sclerotium disease of clover" does not occur On the other hand, when vegetation is still active at the onset of frosts the latter soften or injure the tissues and thus facilitate penetration by and growth of the *Scl. trifoliorum*, the apothecia and ascospores of which effect their differentiation even towards the end of autumn, the fungus being markedly psychrophile.

812 – ***Ustulina zonata* on *Hevea brasiliensis* in the Federated Malay States** (1)

— SHARPLES A., in *The Agricultural Bulletin of the Federated Malay States*, Vol. IV, No. 4, pp. 98-105. Singapore, January 1916.

*Ustulina zonata* (Lév.) Sacc. caused extensive damage in 1915. It spread more and more in *Hevea brasiliensis* plantations in the Federated Malay States.

It has been noted that the attacks of boring insects are almost always accompanied by the presence of fungi. The latter, by weakening the wood, facilitate the boring of the tunnels both by the larvae and the adults. The

(1) See *B.* Sept. 1915, No. 981. (*Ed*).

fungus in turn utilises these hollowed out parts to penetrate downwards. This double attack often kills the tree, and the injury thus occasioned, especially in 10 to 12 year old plantations, is at times very great.

Means of control : 1) cut off the diseased parts unsparingly and tar the wound ; 2) dig out and destroy old stumps, which are more often than not a source of propagation of the disease.

813 – **Fungoid Diseases of the Sugarcane at Tucuman (Argentina).** — CHAVANNE JUAN, J. in *Ministerio de Agricoltura de la Nación, Dirección General de Enseñanza e Investigaciones Agricolas, Sección Escuelas Especiales*, Year 1916, No. 51, pp. 5-32, 2 Pl. Buenos-Ayres 1916.

A list and description of the fungoid diseases which attack the sugarcane at Tucuman.

1) " Polvillo " or " gangrena humeda ". — According to the writer, this disease is identical with the " top-rot " (" pokkahbong "), already discovered and studied without much result up to now in various sugar-growing countries (Java, Mauritius, Demerara, etc.). The infected plants can at once be detected by their chlorotic appearance; the leaves lose their gloss and rigidity, the apex droops, the tops of the canes show marked signs of disease which increase and spread downwards along the stalk. The infection spreads from without inwards, and from the young to the older portions of the plant. It attacks the base of the leaves, blocks up the veins and thus prevents circulation of the lymph elaborated in the leaf substance. The infected sheaths become leathery and stiff, thereby hindering the growth of the stalk. Although the pathological evidence as a whole points very strongly to a bacterial cause, the almost constant presence of larvae or other small organisms in the infected tissues suggests that these animal parasites may play an important part in the growth and spread of the disease. The larvae met with most frequently are those of diptera almost all belonging to two species, namely : *Euxesta chavannei* (1) and *E. argentina* Brèthes. If larvae of these diptera taken from diseased plants are introduced into a deep wound produced artificially in the region of the terminal bud, the characteristic symptoms of " polvillo " will eventually occur. A number of lengthy experiments in field and laboratory were carried out in order to discover the cause of this disease. It is contended that there is no specific bacterium of the disease, or obligate parasite the action of which is alone sufficient to rot the crown of the cane, but that it is due to decomposition produced by various micro-organisms not yet determined, which penetrate the plant through lesions caused by insects or other agencies.

It is hardly possible to ascertain accurately the origin of this disease in the Tucuman plantations, the data available only relating to those years when, as in 1893-1894, " polvillo " attained large proportions and wrought considerable havoc. The cultivated sugar cane varieties are not all equaly liable. Some kinds brought from Java (" P. O. Java 36 " and " P.O. Java 213 ") as also " Cayana Roxa ", " Verde de las Antillas ", and " Sin Nombre " are distinguished by a high degree of resistance.

(1) See *B.* Nov. 1914, No. 1079. (*Ed*).

2) *Cercospora Kopkei* (" enfermedad de las manchas rojizas "). — In spring and autumn, especially during the rainy season, the occurrence is frequently noted in the plantation of oblong red spots, irregular in outline, extending over the leaves. When the infection is severe it causes withering. On keeping the infested leaves in a very moist atmosphere, growth of the hyphae of the mycelium of the pathogenic agent, *Cercospora Kopkei*, is soon induced. Using cultures of this fungus it is very easy to produce the disease artificially, though it does not cause great damage, at any rate in the plantations of Tucuman. In any case, it is effectively controlled by means of Bordeaux mixture applied only to the outer and most exposed parts of the plantation, where wind-borne conidia are usually deposited.

(3) *Leptosphaeria Sacchari* (" enfermedad de las manchas anulares "). Oval blotches, 3 mm. in width and 7 to 9 mm. in length, appear on the leaves attacked by this fungus. In an advanced stage of the disease these blotches are white or yellow, dry in the centre and darkest at the edge. The damage caused by *Leptosphaeria* is mostly inconsiderable. For control, it is advised that all the infected parts should be gathered and burnt.

The author also mentions : *Physalospora tucumaniensis* Speg. in Florida, at San Pablo and in New Bavaria: it attacks old and dying leaves, and therefore does no very great harm ; *Venturia sterilis* Speg.; *Phyllosticta Sacchari* Speg., *Melanconium Sacchari* Massee ; *Glenospora Sacchari* Speg., *Fuuago Sacchari* Speg., and *Colletotrichum falcatum* Went., the presence of which however has not yet been definitely established.

814 – **Fungous Diseases of Coffee in Malaya.** — BELGRAVE W. N. C. in *The Agricultural Bulletin of the Federated Malay States*, Vol. IV, No. 4, pp. 111-113. Singapore, January 1916.

The coffee disease known as " leaf spot " caused by *Hemileia vastatrix* occurs locally in Malaya, but not to any considerable extent. The fungi of the genera *Hyalopus* and *Cephalosporium* probably batten on the Hemileia and are always found on the ripe patches of this rust.

The foliage is also attacked but less seriously, by *Phyllosticta coffeicola*, *Coniothyrium Coffeae* and a species of *Colletotrichum*.

Among diseases of the stem is the one called " die-back ", which at present is of no economic importance. On sectioning the woody mass of the infected parts, it is seen to be completely over-run by interwoven hyphae belonging to two fungi of the genera *Diplodia* and *Colletotrichum*.

The mycelium of a basidiomycete, the fructifications of which have not yet been discovered, sometimes develops between the bark and wood of the roots, rotting and destroying the tissue.

There are often found, especially on the " robusta " berries, epithelial spots and lesions due, according to ZIMMERMANN, to the action of weather agencies. They do not injure the coffee, but may lead to the attack of dangerous fungous diseases.

Among the fungi observed on the fruits may be mentioned : *Pestalozzia Coffeae*, *Hemileia vastatrix* and species of the genera *Stilbum*, *Fusarium*, *Coniothyrium* and *Capnodium*, the latter in conjunction with scale insects.

815 - ***Ascochyta hortorum*, a new Pest of the Artichoke in Italy.** — GABOTTO L. in *Rivista di Patologia vegetale*, VIIth Year, No. 2, pp. 45-46. Pavia, March 1916.

In February 1916, the Author observed the presence of *Ascochyta hortorum* (Speg.) Smith on artichokes from the Italian Riviera in the neighbourhood of Genoa. The infested artichokes were only half the normal size and badly damaged. An enormous quantity of brown pycnidia were found on the scales attacked, on the peduncles and inside the rotting receptacles. Many bacterial forms were combined with the fungus.

*A. hortorum*, already reported on several kitchen-garden Solanaceae (1), had not been met with on artichokes. Apparently it has undertaken the conquest of new hosts even belonging to different plant families, which renders it still more formidable.

816 - ***Septoria Apii* var. *Magnusiana* and *S. Apii-Graveolentis* n. sp., injurious to Celery in the Neighbourhood of Petrograd.** — DOROGIN G. in *Министерство Земледѣлія. Бюро по Микологіи и Фитопатологіи Ученаго Комитета. Матеріалы по Микологіи и Фитопатологіи Россіи.* Ministry of Agriculture, Office of Mycology and Plant Pathology of the Scientific Committee. Materials relating to Mycology and Plant Pathology, 1st Year, Part 4, pp. 57-75. Petrograd, 1915.

In a garden near Volkor, Petrograd, a large number of adult celery plants were observed to be affected with a disease the most conspicuous symptom of which is numerous spots on the foliage. In July this disease appeared sporadically on separate plots and beds, and in August the appearance of the diseased areas was very unsatisfactory.

The diseased plants of the different groups presented such divergent characters as to suggest many distinct pathogenic agents. Microscopic observations however only disclosed two species of *Septoria*, which are dealt with in the present work.

The plants attacked by the same parasite may present different symptoms according to cultivation or seasonal conditions, as was ascertained by comparing one year with another or separate distant places, but in the present instance the most divergent symptoms appeared simultaneously and in the same place under quite identical conditions of environment for all plants and groups.

One of the *Septoria* might be identified with *S. Magnusiana* All. (=*Phyllactaena Magnusiana* [All.) Bres.], but the writer, as a result of a careful examination of the morphological and physiological characters, proposes to regard it as a simple variant of *S. Apii* [Br. and Cav.] Chester (= *S. Apii* [Br. and Cav.] Rostr.) ; we should thus have : *Septoria Apii* (Br. et Cav.) Chester var. *Magnusiana* (All.).

The disease caused by this fungus occurs in three different aspects : 1) round red blotches, 5 to 10 mm in diameter, darker towards the edges ; few pycnidia scattered in the blotches, towards the end of the leaves ; 2) ochre blotches, pale, bordered with yellow ; 3) greyish-white blotches with many pycnidia. The blotches may sometimes be completely absent and the pycnidia gathered in small groups spread over the leaf surface.

(1) See *B.* April 1912, No. 745. (*Ed.*)

The other *Septoria* could not be identified with any hitherto known form and is described as a new species under the name of *Septoria Apii graveolentis* n. sp.

The symptoms of the disease are very varied : 1) inconspicuous light yellow spots, diameter 0.5 to 3 mm, the pycnidia spread over the entire leaf on the spots and outside, separately and in groups ; 2) spots of vague outline, reddish-yellow in colour ; the pycnidia, few in number, are first restricted to the leaf tissues, afterwards partly emerging ; 3) round spots, dirty yellow, maximum diameter 5 mm, in which the pycnidia are situated; 4) dark chestnut spots, lighter towards the centre, strewn with pycnidia.

Both with *Septoria Apii* (Br. and Cav.) Chester var. *Magnusiana* and *S. Apii graveolentis* n. sp., the disease begins with the lowest leaves ; these turn yellow without completely withering or drying up. Weather conditions have some influence on the growth and spread of the fungus. After a severe epidemic in 1913, the disease reappeared in the summer of 1914, but disappeared almost at once owing to the drought which prevented germination of the spores.

The *Septoria* have no type of fructification other than the pycnidia. The latter form during the summer, but their spores retain their germinating capacity through the winter and spring. Infected leaves and other vegetable debris remaining on the ground may thus become the source of an epidemic in the following year. The pycnidia also develop in the seeds. They contaminate the young plants from the latter, and eventually, after an incubation period of three or four weeks, produce the characteristic degeneration of the leaf in the already transplanted and growing plants.

The following means of control are advised : 1) careful and thorough examination of seeds ; 2) treatment of seeds with dilute formalin, strength 1 : 300, for 2 hours; 3) removal from seed plots and destruction of all young plants showing light yellow streaks ; 4) picking off the diseased leaves during the summer and pulling up the entire plant in case of very widespread and marked infection ; 5) gathering and destruction of all vegetable refuse after the crop.

Finally, attention is drawn to the fact that this refuse must not be used as manure, even if the infection was very slight and only involved a small number of plants.

817 – **A New Disease of the Bamboo caused by *Sciri hia bambusae* n. sp., in Italy.** — Turconi Malusio in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di scienze fisiche, matematiche e naturali*, 5th Series, Vol. XXV, 1st Half-Year, Part 7, pp. 528-532. Rome, April 2, 1916.

In a plantation of *Bambusa mitis* Poir. in the Botanical Gardens of Pavia, during the summer of 1914 the branches were wholly or partially dried up, whitish in colour and showed a number of small black blisters. The first symptoms of the disease appeared on branches and twigs of all sizes, preferably at the tip, chiefly on the small branches carrying leaves. Small brownish spots or streaks appear and these afterwards spread and combine, forming blotches which finally occupy several internodes. The diseased parts, which are brown at first, gradually turn whitish and dry, becoming

covered at the same time with the characteristic small black blisters. The disease usually extends from the tip towards the base of the branches ; sometimes the infection is confined to the internodes and the middle or base. In these cases the portion of the branch above the infected part dies and dries away, without showing the characteristic fructifications of the parasite, which only form in the infected parts after their death.

This disease is caused by the parasitism of a new species of *Dothideaceae*, of which a description is given in the ascophore form under the name of *Scirrhia Bambusae* n. sp. and in the conidial form under the name of *Melanconium Bambusae* n. sp.

The disease was reproduced by artificially infecting *B. mitis* and *B. gracilis* Hort. with the fungus.

818 - ***Ascochyta clematidina*, on Stems and Leaves of Clematis.** — GLOYER, W. O. in *New York Agricultural Experiment Station, Geneva, Technical Bulletin* No. 44. pp. 3-14. Plates I-IV. Washington, 1915.

The rotting of the stems and mottling of the leaves of *Clematis* are due to the fungus *Ascochyta clematidina* (Thümen).

The disease first occurs in the form of blotches on the surface of the leaves. On drying, these blotches take on a dark chestnut colouration, with red margins. From the leaf the mycelium makes its way down the length of the petiole as far as the axil where it develops in the surrounding tissue, forming a continuous zone of infection which causes the death of the portions of the plant above this point. The parasite may also develop directly on damaged epithelium in the neighbourhood of the leaf axil.

In both cases new buds and shoots continue to develop below the infected region, until the mycelium of the fungus, spreading downwards towards the base of the plant, eventually infects the whole of the aerial portion and causes the death of the host.

Hibernation in the open, whether in artificial culture or in infected vegetable débris, does not destroy the parasite. As soon as the temperature permits, growth recommences.

*A. clematidina* is easily isolated and develops readily in any of the usual media. Inoculations with pure cultures (mycelium) into *Clematis paniculata* and *C. Jackmanni* gave positive results, and the mycelium derived from artificially infected plants and inoculated on healthy specimens readily reproduced the disease.

*A. clematidina* is clearly distinct from other more common species and inoculation experiments on pumpkins, beans, peas and elms gave negative results.

Sprays containing the spores of the parasite in suspension produce the characteristic blotches on the leaves of *Clematis*, especially when the temperature is about 73° F.

The following methods of control are recommended : 1) transplantation into the open when one year old, allowing sufficient space between the plants for access of air, sun, etc; 2) cutting and destroying all infected portions, subsequently spraying lightly with fungicides. The following mixture is

recommended : Sulphur 1 lb, soft soap 6 lbs, water 12 $^1/_2$ gallons ; 3) remove and destroy all vegetable remains among which the parasite is capable of living as a saprophyte.

819 - **Investigations into a Disease of the Cones of *Pinus pinea* in Italy.** — PETRI L. and ADANI A. in *Annali della R. Accademia di Agricoltura di Torino*, Vol. LIX, 23 pp. 12 Fig., 1 Pl. Turin, 1916.

The disease of the cones of *Pinus Pinea* L., long known to gatherers of cones in the pine groves of Migliarino, San Rossore, Cecina and Castel Fusano, under the name of " pine gallerone " and " pine pagliose ", are due to the same identical pathogenic agent. The symptoms caused by the latter however differ to some considerable extent, according to whether the disease develops in autumn or spring.

" Pine gallerone ". — An ochre hued spot first appears in May or June and from the line of contact between two adjoining scales rapidly spreads right through the cone. The loss of water being fairly large, the outer surface of the scales appears shrunken. Resin exudes here and there from the blackest portions. At the points where the infection is oldest, black pustules of irregular shape form, pushing up and splitting the epiderm of the scales. The shell of the seeds is normal, but the kernel is reduced to a grey or yellowish powder. The weight of these cones is lighter than that of healthy cones which have reached the same stage of development.

The browning of the scale tissue and the destruction of the kernels are accompanied by the presence of the mycelium of a fungus, which spreads from the upper surface of the scales through their thickness and penetrates the endosperm of the seeds, the oily substance of which appears to act as a powerful stimulant on the mycelium in question. The black external blisters are the pycnidia of the fungus, which may be classified as a new species of *Sphaeropsis* (*Sph. necatrix* Petri et Adani).

" *Pine pagliose* ". — The first spots marking the infection are observable in September and throughout the month of October. The external characters of the diseased cones do not differ very much from those of the " pine gallerone ". Thus, the discolouration of the scales, the exudation of resin, destruction of the endosperm, the presence of the mycelium and the pycnidia of *Sphaeropsis* are characters common to the two forms of degeneration. In " pine pagliose " however the weight is equal, or nearly so, to that of healthy cones, the surface of the scales does not shrink, a number of seeds remain intact and retain their commercial value.

In these cones, owing to the more advanced lignification of the tissues and the less favourable season, the infection proceeds more slowly ; it was therefore easier to ascertain the course it takes inside the cone. The mycelium penetrates between the scales and rapidly attacks the soft parenchyma which envelopes the seed. From this point it spreads through the thickness of the scale towards the lower (external) surface from which the sporigenic organs afterwards escape.

From what has just been said, it will readily be understood that the two names given by pine cone gatherers to the diseased cones only correspond to two slightly different aspects produced by the same pathogenic cause in

the nearly ripe cones, according to whether they are attacked in spring or autumn. It is quite natural that cones attacked in May or June when the tissues are soft and growth is still in progress should suffer a large loss of water, and consequently be very light ; besides the seeds must obviously suffer as a whole from the consequence of the infection owing to the fact that between spring and autumn there is plenty of time for the parasite to exert a destructive action on the entire cone. On the other hand, when the infection occurs in autumn, just before the cones are gathered, the time available for the parasite to encroach on the seeds is very short, both because the spread of the mycelium is hindered by the thoroughly lignified and fully developed tissues, and because the drying of the cones for the purpose of extracting the seeds stops the further spread of the mycelium. If, however, owing to favourable circumstances, the infection is able to continue for a long time, the cones attacked in autumn (" pine pagliose ") may have numerous features in common with those attacked in the spring ("pine gallerone").

The immediate cause of the disease is *Sph. necatrix.* This is proved not only by microscopic examination, but also by experiments of inoculation on healthy cones, in which the disease was successfully reproduced in this way.

As regards means of control, the following are advised : 1) complete gathering and burning of the diseased cones ; this precaution must be strongly recommended to pine cone gatherers, who often omit to gather the " pine gallerone " which are richer in pycnidia of the parasite than the " pine pagliose ". The cones of the " pine gallerone " should even be gathered as early as June, when dispersion of the spores has already begun, because on this depends in part the intensity of autumn infection ; 2) thinning out the pine grove as much as possible, so that the plants are under the most favourable conditions and get the largest possible quantity of light and air. There should therefore be a distance of at least 33 feet between the adult plants ; very dense old pine woods in which there are from 100-110 trees per acre are the worst sufferers from this disease.

320 – **Common Phosphorescent Toadstool *(Pleurotus nidiformis)* and " Sticky timber Pholiote " (*Pholiota adiposa*), Agaricineae attacking Wood, in Australia.** — CLELAND J. BURTON and CHEEL EDWIN in *Agricultural Gazette of New South Wales*, Vol. XXVII, 3rd. Part, pp. 201-202, Pl. 5-6. Sydney, March 2, 1916.

A description of *Pleurotus nidiformis* Berck. (common phosphorescent toadstool) and *Pholiota adiposa* Fries (" sticky timber pholiote "), which destroy the wood by piercing it with their mycelial filaments and thus bringing about decomposition.

The former occurs widely in all the States of the Australian Commonwealth. It grows at the foot of living tree trunks (Eucalyptus and other species), or on dead stems. It is perhaps of no great economic importance. Nevertheless, it would be advisable to destroy it by burning wherever found. It has been described by various authors under different names : *P. candescens, P. lampas, P. phosphoreus* and *P. illuminans.*

*Pholiota adiposa* appears on the trunks of trees at a height which may be 22 ft and more. In Europe this fungus is very injurious. In Australia

it is found only at one point in New South Wales in dense wood o Mount Wilson, where it was perhaps introduced with European tree species It has also been reported in Queensland. It is recommended to destroy i by fire whenever found, in order to extirpate it completely from Australi while still very rare there.

## WEEDS AND PARASITIC FLOWERING PLANTS.

821 – **Goatsrue (*Galega officinalis*), a Weed in New Zealand.** — COCKAYNE A. H in *The Journal of Agriculture*, Vol. XII, No. 2, pp. 125-130, 1 Pl. Wellington, February 2 1916.

The Noxious Weeds Act, which has been in force for more than sixtee years in New Zealand, makes the destruction of certain plants obliga tory. Some of these are regarded as noxious throughout New Zealand others only in certain districts, according to a declaration by the local au thorities.

The goatsrue (*Galega officinalis*) has also just been included in thi latter category.

This species of Leguminosae cultivated in gardens in several parts o New Zealand, has only become wild on the banks and in the old alluvia soil of the rivers Manawatu and Pohangina. It spreads rapidly along road paved with the gravel of these rivers. As usually, *Galega* is not eaten i sufficient quantities by animals to prevent it flowering, it spreads rapidl wherever it takes hold, unless the soil is covered with a thick coating of grass In New Zealand, the *Galega* often attains 3 ¼ ft. and more in height. It gener ally flowers towards the second week in December and remains in flowe for about two months. If mown a little before flowering, it flowers in March if the plants are cut at intervals, they may even flower three times in on season. The ordinary method, therefore, which consists in preventing th flowering of weeds by a single mowing per year, is almost valueless for thi weed, which must be turned in.

The *Galega* is regarded as a weed because : 1) it is very little liked b cattle ; 2) it tends to choke more desirable plants ; 3) it is considere poisonous.

Towards the end of autumn and in winter, animals feed to some smal extent on the branches of the plant when they begin to dry. The same i the case at the beginning of spring, before the branches harden.

On the other hand, all animals refuse the plant during summer, whe it is in full vigour. This seems to be due to the bitterness of its leaves. More over, at some seasons its leaves are markedly poisonous to sheep, and per haps also to young cattle. Experiments in France have shown that 1 lbs. of these leaves are sufficient to kill a sheep.

Goastrue, however, has some useful properties. It has even been advis ed as a forage crop, and is in fact cultivated for that purpose in some parts of Switzerland. If mown when still tender and allowed to wither slightly, it is agreeable to cattle and may be fed to them without danger.

The writer thinks that Goastrue would do excellent service as green manure, especially for very light sandy soils, for which it would perhaps be better even than lupin. It only remains to ascertain whether turning in would suffice to destroy it. Goastrue is plentifully provided with root tubers.

To control this weed, it must be mown at least three times a year, or turned in and a mixture of grass consisting principally of *Dactylis glomerata* and *Lolium italicum* sown on top. It would also be as well, for some time, to roll the grass-land thoroughly. In those parts where the plant specially abounds, clearing of the grass-land and conversion into arable land is advisable.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

822 – **The Entomological Society of Moscow, Russia.** — I. Boldirev V. F. History of the Foundation of the Entomological Society of Moscow, in *Извѣстія Московскаго Энтомологическаго Общества* (Bulletin of the Entomological Society of Moscow), Vol. I, pp. 9-13, Moscow, 1915. — II. Kulagin N. M. Programme of Work of the Entomological Society of Moscow, *Ibid.*, pp. 1-8. GENERAL

The Entomological Society of Moscow, the third of its kind in Russia, was founded in 1913. It owes its formation to the combination of three Associations of Entomologists of Moscow which had until then existed separately.

After referring to the importance of insects to agriculture, the writer adds that the Society has two methods of achieving its object, one is that of enriching science by means of original research, the other the spread of scientific knowledge and training of young scientists.

As regards its practical aims the new Society has already made its first contribution by instituting a short course (from the 16th February to the 10th March 1915) for the training of a technical staff in the control of locusts and field voles. The number of persons attending the lectures was about 150. Most of the hearers consisted of male and female students of the Higher Schools of Moscow.

The said Society has its own organ: « Извѣстія Московскаго Энтомологическаго Общество » (Bulletin of the Entomological Society of Moscow), the first volume of which appeared in 1915. In addition to original work, annual reviews of the literature relating to entomology are to occupy a large space in this publication.

823 – **Insects Pests of Plants Cultivated in European Russia, in 1914** (1). — Kulagin N. in *Извѣстія Московскаго Энтомологическаго Общества* (Bulletin of the Moscow Entomological Society) Vol. I, pp. 136-161. Moscow, 1915.

The above contains a summary of the facts scattered throughout Russian literature regarding the insect pests of cultivated plants reported in

(1) See the article by the same writer: " The principal Insect Pests of Plants cultivated in European Russia during the last twenty years ", in *Ежегодникъ Главнаго Управленія Землеустройства и Земледѣлія по Департаменту Земледѣлія.* (Year Book of the Department of Agriculture). IVth Year, pp. 585-638, Petrograd, 1913 ; and the article by Portchinskij I. A., *Ibid.*, VIIth year, pp. 348-360, Petrograd, 1914. (*Ed.*)

1914 in different parts of European Russia. The question of the type of weather in that year is also discussed.

The year 1914 was exceptionally abnormal, The second half of the winter of 1913-1914 was exceedingly warm throughout Russia, and little snow fell, except in the governments of the north-east and east. Thus, in January, the mean temperature in Southern Russia was 6° C (10. 8° F.) above the normal. February was exceedingly warm. The positive fluctuations amounted to 9°C (16. 2° F) in the central and south-eastern parts of Russia. The spring became dry with the return of cold. The first half of the summer (June, July) was very hot and dry in northern and middle Russia. The south, and particularly the south-west, suffered from torrential rains. The second half of the summer was very cool. In August, the temperature was 4°C (7.2° F) below the normal (in the central governments). In eastern Russia the rainfall was much above the normal, while in the western part the drought continued. The first half of the autumn, up to the 10th October was rather rainy, but soon afterwards anticyclonic conditions became established. From September to November the temperature was below the normal throughout the country. It may therefore be said that the year was not favourable to insect development ; the early spring, the return of cold during that season and afterwards the drought, all being unfavourable factors.

Among insect pests in 1914, Elateridae occur most widely: injury caused by them was reported in 18 governments, with different climatic conditions (e. g. Moscow and Astrakhan). It was not possible to ascertain the number of species in question. In any case the presence of several species was reported in the government of Kaluga.

The most serious damage was caused by the following insects : *Oria* (*Tapinostola*) *musculosa* Hb. ; *Euxoa* (*Agrotis*) *segetum* Schiff. (governments of Ekaterinoslav and Astrakhan) ; *Pirausta nubialis* Hb. ; Elateridae ; *Lema menalopa* L. ; *Anisoplia austriaca* Herbst ; *Oscinella frit* L. (government of Orel) ; *Cephus pigmaeus* L. (government of Ekaterinoslav), and locusts.

The insect pests reported in Central Russia exclusively were as follows : *Feltia* (*Agroti*) *exclamationis* Schiff. ; *Hydroecia nictitans* Bkh. ; *Ochsencheimeria taurella* Schiff. ; *Lasioptera cerealis* Lind. and *Apion* sp.

*Phlyctaenodes sticticalis* L. was recorded in 9 governments, but only caused injury in that of Kuban, and, to a less extent, in that of Kharkov.

Below is a detailed list of the insect pests, in which, *for the sake of brevity the name of the town stands for that of the government where the injury was caused.*

I) Coleoptera. — (1) *Zabrus blaptoides* Kreuts and *Z. tenebrioides* Goeze, both attacking wheat, the former in Ekaterinoslav, the latter in Bessarabia ; (2) *Ophonus calceatus* Duft. at Ekaterinoslav on *Setaria germanica* ; (3) *Blitophaga undata* Müll., at Stavropol, on the young leaves of barley and wheat ; (4) *Meligethes aeneus* F., at Kiev, on wheat, on flowers of saffron *Salix*, *Caltha* and *Viola* ; in Bessarabia, on the floral buds of *Brassica Rapa oleifera* ; (5) Elateridae were reported at Petrograd, Novgorod, Pskov, Viatka, Perm and in Livonia ; *Agriotes lineatus* L. caused extensive damage

to spring cereals, at Moscow; at Kaluga the following species were observed: *Limonius aeruginosus* Oliv.; *Agriotus lineatus* L.; *A. sputator* L. and, to a less extent. *A. obscurus* L. and *Athous niger* L.; at Orel together with *A. segetis*, a few specimens of *Athous niger* L. were recorded; Elateridae were reported at Tula and Riazan; at Kharkov, *Agriotes* sp. (?) caused injury to wheat (160 acres were resown) and to cabbages; at Kiev, beets were attacked by the adult *A. lineatus*; in Podolia, by *Athous, Limonius, Melalotus* and *A. lineatus*; at Ekaterinoslav, *A. lineatus* and *A. niger* caused great havoc to wheat and maize; at Astrakhan, *A. lineatus* produced wide injury to rye (in April), and to different kinds of melons (May and June); in Bessarabia, *A. ustulatus* was found on the ears of barley; (6) *Omophlus lepturoides* Fabr.), in Bessarabia, devoured young heads of rye; (7) *Podosta nigrita* F. was observed in fairly large numbers on the ears of wheat at Ekaterinoslav, its injurious action in relation to grain crops however is not yet quite clear; in the government of Kuban, it caused injury to beet; at Stavropol it was found in quantities in grain fields, on *Bassica Rapa oleifera* and other plants; (8) *Opatrum sabulosum* L., at Kiev, Astrakhan and Kharkov, caused injury to peas, melons, water-melons, cucumbers and young wheat plants; (9) *Gonocephalum pusillum* Fabr., at Astrakhan, attacked plots sown with wheat; (10) *Crioceris merdigera* L., at Kiev, attacked asparagus and onions; (11) *Lema melanopa* L. caused injury to grain crops at Kharkov, Kiev, Stavropol, in Bessarabia and the Crimea; (12) *Choetocnema hortensis* Geoffr, in larval form, was found in the stalk of barley at Kiev; (13) *Choetocnema* sp. was reported at Stavropol; (14) *Psylliodes attenuatus* Koch caused injury to young hemp plants at Orel and in Bessarabia; (15) *Haltica euphorbiae* Fabr. was observed at Ekaterinoslav; (16) *H. oleracea* L., at Riazan, caused great damage to lucerne; (17) *Cassida nebulosa* L., at Kiev, Kharkov and Ekaterinoslav caused damage to the beet; it was also found on maize at Ekaterinoslav; (18) *Laria* (*Bruchus*) *pisi* L., at Riazan, caused great injury to newly sown peas; it was also met with at Ekaterinoslav; (19) *Otiorrhynchus ligustici* L. at Tchernigov, in the larval stage, injured roots of clover; at Kharkov it attacked clover and lucerne; at Kherson, the roots of lucerne; at Kiev, the adults preferred the leaves of the peas to those of the beet; at Stavropol this species was found on the leaves and roots of lucerne; (20) *Sitones lineata* L., at Orel, Riazan and Kharkov, on several pulses; also found at Stavropol; (21) *Baris chloris* Fabr. greatly injured (up to 80 %) kohlrabi, the larvae devouring the whole of the stems; rarely met with on the roots; at Kharkov the insect caused serious injury to cabbages; (22) *Apion* sp. attacked clover, at Orel; and was found throughout Riazan; at Tula the number of larvae which usually feed on clover had considerably diminished, in 1914 according to SAPOZKO, the excessive drought retarding. development and flowering of the clover, and consequently a part of the generation of the clover weevil was displaced in its life cycle; according to STCHERBAKOV'S data obtained at the agricultural experiment Station of Chatilov (government of Tula), *Apion* is harmless agriculturally, and cannot be deemed to have any adverse influence on the production of clover seed; at Tchernigov the weevil was found on a

clover field, causing a continuous falling off in production; (23) *A. pomonae* Fabr. was found at Kharkov in small quantities on peas and vetches (with *Sitones lineatus*); (24) *A. craccae* L., at Riazan, was observed on vetches and oats ; (25) *Melolontha melolontha* L. was noted at Orel, Kuorsk, Kharkov and Ekaterinoslav ; (26) *Anisoplia austriaca* Herbst caused great injury at Kharkov, Ekaterinoslav and Kherson ; it was observed at Stavropol and in Bessarabia ; (27) *A. crucifera* Herbst, at Kaluga, caused little harm ; at Riazan, more extensive damage; (28) *A. segetum* Herbst appeared in hosts during the flowering of the rye but occasioned no injury ; they were also observed at Stavropol ; (29) *A. cyarthigera* Scop. was recorded at Stavropol; (30) *A. agnota* and *A. ferraria* were abundant in Astrakhan at the time of earing of the wheat and rye ; (31) *Epicometis hirta* Pod. and *Oxythyrea funesta* Pod. in Bessarabia, devoured the ears of rye, and *O. funesta* the flowers of wheat ; (32) *Pentodon idiota* Herbst, at Ekaterinoslav, Kherson and in Bessarabia, caused injury to maize ; at Kiev. it was found in a ditch surrounding a beet field.

II) Lepidoptera — (1) *Ochsencheimeria taurella* Schiff. caused extensive damage at Orel, Riazan and Kaluga ; (2) *Talis quercella* Schiff., destroyed several hundred acres of pasture in April and May at Astrakhan; (3) *Phlyctaenodes sticticalis* L. was observed in small numbers at Riazan on the grass, and in an oak forest ; damage not noted ; a few at Kharkov, injuring beets in some localities ; also a few at Kiev ; at Ekaterinoslav the larvae injured maize ; fewer in Bessarabia than in 1912 and 1913, and observed on lucerne ; hardly noticed in the Crimea ; at Kherson (experimental field) the lucerne was completely destroyed, and rye half destroyed ; at Ekaterinoslav, the first generation larvae injured the beet sowings ; a normal number also seen at Astrakhan ; (4) *Pyrausta nubilalis* Hb., caused great damage at Riazan to hemp, which was completely destroyed in some localities ; injury noted at Kiev to maize, millet, and once to mustard ; apparently the larvae also injure the sunflower ; in Bessarabia, in the government of Tchernomorsk, and at Ekaterinoslav, this insect did extensive damage to maize ; at Ekaterinoslav, in some localities, the injury destroyed the entire crop; (5) *Acronycta rumicis* L., at Kiev. observed in the larval form on the leaves of the ornamental sunflower, the raspberry bush, and *Rumex confertus* Willd. ; also found on maize and on vine leaves ; (6) *Plusia gamma* L. was noted at Kiev, adult in spring wheat sowings, and larvae in beet fields ; also reported at Astrakhan and in Bessarabia ; (7) *Trachea (Hadena) basilinea* Tb. observed at Orel, at Riazan (on rye ears and in grain) ; likewise at Kaluga and Ekaterinoslav, where it occurred widely (the young larvae found on oats) ; (8) *Hydroecia nictitans* Bkh., in considerable quantities at Tver, Tula, Orel, Riazan and Kaluga; (9) *Oria (Tapinostola) musculosa* Hb. at Ekaterinoslav was one of the insects causing most havoc to grain crops; in 1913, 376,560 acres were attacked; in 1914 the insect was found nearly as plentifully as in the previous year, but involving a larger area : of 754 625 acres of spring cereals, 200 560 were damaged or destroyed, *i. e.* about 25 % ; M. Vitkovskij gives the following features observed in the growth of the insect: (*a*) early emergence of the larva (first injuries noted 4th April);

(*b*) variations in the date of emergence of larvae (11th May in the Pavlograd district, the smallest larvae were observable and also those ready to accomplish the next phase of development); (*c*) larva passing into the open in spite of heat ; the death of the insect observed to be due to parasitic hymenoptera and an unknown cause ; the same worker observed a fresh kind of damage caused by the insect : on examining the field attacked one is struck by the completely dried and whitened ears, the grain has not formed, at the upper internode the stalk of the ear is destroyed, on the leaf sheaths the inlet and exit holes of the insect are found ; at Kharkov it injured spring wheats, barley and oats, up to 90 % of the crop; damage was also observed in the Crimea ; in the Don region the insect injured 2725 acres, 750 acres being completely destroyed ; (10) *Euxoa* (*Agrotis*) *tritici* L., at Astrakhan injured spring cereals ; (11) *Euxoa* (*Agrotis*) *segetum* Schiff. observed at Viatka, Perm, Ufa, Vitebsk, Smolensk, Kazan, Tambov, Simbirsk, Tula, Riazan, Kaluga, Orel, Kharkov, Kiev ; damage found on some farms of Voronej and Poltava, and in Podolia serious damage at Ekaterinoslav, Samara and Saratov ; the insect observed at Astrakhan and in Bessarabia ; (12) *Feltia* (*Agrotis*) *exclamationis* Schiff. noted at Riazan; (13) *E. segetum* and *E. exclamationis* are two competing species as regards time of flight, and one preys on the other ; at Tula the number of *E. exclamationis* almost exceeded that of *E. segetum* ; (14) *Episilia* (*Agrotis*) *simulans* Hufn. noted at Kiev on rye and on beet leaves ; the larvae destroy the stalk almost level with the ground, the plant then falls and is completely devoured.

III) Hymenoptera. — (1) *Cephus pigmaeus* L. : a small number observed at Riazan ; also noted at Orel, Ekaterinoslav, in considerable quantities ; at Kherson it occurred everywhere in the same amount as in previous years ; also noted at Stavropol ; (2) *Athalia spinorum* Fabr. at Kiev, according to the observations of V. M. Kostinskij, oviposited on the edge of hemp leaves ; at Kharkov, Kherson and Astrakhan it damaged hemp and turnips ; (3) *Bruchofagus gibbus* Boh., at Orel, caused much damage to seed clover.

IV) Diptera. — (1) *Hylemyia* (*Leptohylemyia*) *coarctata* Fall., at Orel, occasioned less injury than in 1913 ; at Kiev the damage to the sowings of spring wheat was 10 % ; the rye sowings suffered 12.5 to 15 %; (2) *Agromyza florum* Fabr. noted among injurious insects at Kiev ; (3) *Oscinella frit* L., observed at Ufa, Orenburg, Smolensk, Moscow and in Livonia ; at Orel, it wrought much havoc to spring grain crop sowings ; the early sowings (25th July) of rye and barley suffered more than the late (17th August) ; traces of damage were found at Riazan ; at the agricultural experimental Station of Chatilov (province of Tula) Stcherbakov observed injury occasioned by this dipteron to maize, the damage being of the typical character of that occasioned to grain crops ; the maize plant was not destroyed, it had a very strong stalk and in this way proved its capacity to produce a good cob; at Kiev, the insect caused injury to spring cereals; in some localities, in April, the injury wa 44 % of the sowings ; this dipteron did damage at Ekaterinoslav ; inconsiderable injury was observed at Kherson to oats and barley, and on some farms in Podolia ; (4) *Chlorops taeniopus* Meig. was noted at Riazan and Orel ; it seems to be widespread at Ekater-

inoslav and to attack barley by preference ; on the 11th June VITKOWSKIJ observed a new injury caused by the insect : it attacks the growing bud, upward growth is checked, the plant swells abnormally and becomes a monstrosity, the height of these monstrosities does not exceed 6 inches while the neighbouring plants attain 2 ft. 3 ½ inches and more and have already eared ; the monster stalk attains 9 to 12 centimeters in diameter ; (5) *Cecidomyia destructor* Say was observed at Perm, Ufa, Riazan, Tula and Ekaterinoslav ; at Orel it injured the spring wheat and rye ; was reported on some farms in Podolia and in the Crimea ; (6) *Lasioptera cerealis* Lind, found at Orel and Riazan ; in the latter government it was accompanied by *Oscinella frit* L.

V) HEMIPTERA. — (1) *Aelia acuminata* L. and *Eurygaster maura* L., occurring very widely at Riazan ; the last named species was observed on rye ears ; the insect was found beneath stacks (40-56 individuals found beneath two stacks in the district of Mikhailovsk) ; the migration of the insect to the forests began in the middle of July, and the number there had increased from the middle of August ; (2) *Aelia acuminata* and *E. integripes* Put. were found on cultivated plants at Stavropol ; (3) *Eurygaster* sp. was recorded among injurious insects at Orenburg ; (4) *Trygonotylus ruficornis* Geof. was observed at Riazan and Stavropol ; (5) *Adelphocoris lineolatus* Goeze, at Kiev, was seen by VASILIEV to feed on the nectar of the flowers and juices of the floral buds of the mallow ; at Ekaterinoslav it devoured lucerne, and at Kherson it was found on the same plant ; at Kuban it was found on beet sowings ; it is mentioned among injurious insects at Stavropol ; (6) *Macrosiphum granaria* Kirby, at Riazan, where it was found on the leaves of rye, wheat and oats (the aphid sucked the juice from the leaf and the base of the ear) ; on the glumes of oats, the insect produced white spots and caused reduction of the grain ; the attacks were in the proportion of 20 to 25 % ; at Ekaterinoslav the aphid was found on the leaves and ears of barley ; (7) *Pentaphis trivialis* Pass. was observed in large quantities on the roots of barley at Ekaterinoslav ; it was also reported in the Crimea ; (8) *Toxoptera graminum* Rond. ; at Ekaterinoslav, severely attacked barley and oats ; (9) *Tetraneura rubra* Lich. ; was observed at Ekaterinoslav and in the government of Tchernomorsk ; (10) *Brachycolus noxius* Mordw. ; presence recorded in the Crimea ; damage not so extensive as might have been expected at the beginning of spring, which is to be put down to the strength and uniformity of growth of the grain crops.

VI) ORTHOPTERA. — (1) *Pachytylus migratorius* L. ; at Orel a small number were found, and also at Riazan ; at Kharkov, on the 9th July at 10 p. m., the flight of a considerable swarm of these insects was observed ; at Ekaterinoslav the insect was noted on maize (with *P. donicus* L.) ; at Astrakhan locust control was organised in a locality where they covered 102 ½ acres, the cost was about £ 30 ; the same control was undertaken at Stavropol, Ekaterinodar, Baku and Elisavetpol ; (2) *Calliptamus italicus* L. caused injury at Saratov and Astrakhan ; (3) Locusts (species not identified) : at Orenburg locust control was organised from 15th May

till the beginning of July, the cost exceeding £ 400 ; the same was done at Baku, Elisavetpol, Ekaterinodar and in the region of Tourgajsk.

VII) THYSANOPTERA. — (1) *Anthothrips aculeatus* Fabr. was met with very frequently on rye ears at Kaluga ; (2) *Haplothrips tritici* Kurd. and *Stenothrips graminum* Usef. were observed in considerable quantities ; the former sucked the glumes and grain of rye, the latter was found on oats and seemed to lead to whitening of the ears; in June and July *H. tritici* was found in quantities on the inflorescences of red clover (it was less frequent on white clover) ; at Tchernigov, it was observed that the Thysanoptera had been carried away from the land where previously found, through the agency of red clover roots ; at Ekaterinoslav they occurred very widely and attacked wheat and oats (in the latter case, *H. tritici*); at Astrakhan these Thysanoptera caused injury to wheat, and were found very extensively on this crop in Bessarabia.

VIII) INSECTS ATTACKING SPECIAL CROPS. — (A) Beetroot — (1) *Bothynoderes punctiventris* Germ., at Kiev, in 1914, as in the previous year, it was found in smaller numbers, so that no control measures were organised on many farms ; at Kharkov, Tchernigov, Ekaterinoslav and Ekaterinodar, it caused injury ; (2) *Lixus ascanii* L. : at Ekaterinodar, M. VASILIEV noted its eggs, yellow in colour, on the stalks of *Amaranthus blitum* L. with which a beet field was severely infested ; (3) *Psalidium maxilosum* Fabr. observed at Ekaterinoslav ; (4) *Tynamecus palliatus* F. noted at Kiev ; (5) *Liparus coronatus* Goeze found on May 14 in the small ditches surrounding land under beet, on the 17th May it was observed that the eggs had been laid in the soil ; on the 29th May some eggs were found near the roots of a carrot ; on the 8th June the eggs were found laid on carrot roots ; at the end of June larvae appeared, and on the 1st September they returned into the ground; the adults devoured the leaves of the beet (beginning with the parenchyma of the midrib) and the carrot (eating transversely) ; (6) *Cassidula nobilis* L. noted at Kiev ; (7) *Castroidea polygoni* L. noted at Kiev ; (8) *Thanotophitus sinuatus* L. at Kiev ; the larvae injured the crops of beet and *Chenopodium album* ; in the laboratory of the agricultural Station of Smielna, the adults readily eat the leaves of the beet ; (9) *Aphis euvonymi rumicis papaveris* F., at Kiev ; the insect was found on the upper and under surface of beet leaves ; viburnum and jasmine are centres of propagation of this aphid on the beet; VASILIEV found females of this insect on the roots of beets left on the field after the crop ; (10) *Macrosiphum circumfectum* Buskton, at Kiev, found on the beet; (11) *Lygus pratensis* L. appears to winter in the adult form ; VASILIEV found this insect, in 1913, on the upper part of the root stock of rotted beets which had lain on the field through the winter ; on the 18th July 1914, eggs were found on a fennel stalk ; (12) *Piesma capitata* Wolff. : at Kiev. this insect had laid its eggs on the lower part of beet leaves in spring and summer ; there are 2 generations and the adults of the second hibernate ; on the 3rd August VASILIEV observed the insect feeding on the nectar of the mignonette ; (13) *Bibio hortulanus* L. and *Bibio marci* L. at Kiev, the former in small numbers, but

the latter in considerable quantities in April ; at Astrakhan both species appeared, and they were numerous throughout the government.

Among other insects injuring the beet, there were also observed, at Ekaterinodar, the " earth fleas " (*Halticini*) and the larvae of the cockchafer. Other insect pests of the beet are indicated above.

(B) Mustard. — At Astrakhan, *Plutella cruciferarum* Zell. injured this plant in the region of Jimkursk ; in June, about 2750 acres were destroyed ; the presence was also observed of: *Pieris daplidice* L., *P. rapae* L., *Colaphus sophiae* Schall., *Phyllotreta cruciferae* Goeze, *Athalia spinarum* Fabr., (*Pyrausta nubials*, at Kiev, was referred to above).

A list of 32 publications accompanies the paper.

824 – **Diaspids Collected in Southern Italian Somaliland.** — MALENOTTI ETTORE in *Redia*, Vol. IX, Part 2, pp. 321-358, Pl. VIII-X. Florence, March 24, 1916.

Description of the diaspids gathered in 1913 by the Stefanini-Paoli Scientific Mission, in Southern Italian Somaliland :

(1) *Aspidiotus* (*Evasp.*) *destructor* Sign. (= *A. transparens* Green, *A. translucens* Ckll.), on leaves of *Cocos nucifera*, at Merca, and on leaves of *Xylocarpus obovatus* near the mouth of the Djouba, June 1913; (2) *A.* (*Evasp.*) *cyanophylli* Sign., on leaves of *Manihot Glaziovii* at Djélib on the Djouba, June 1913; (3) *A.* (*Evasp.*) *orientalis* Newst. (= *A. osbeckiae* Green, *Chrysomphalus pedroniformis* Ckll.) on branches and fruits of *Calotropis procera* and on fruits of *Solanum arundo*, at Moukdicha, May 1913; (4) *Chrysomphalus rossi* (Mask.) Ckll. var. *ferrandii* Malen. n. var., on leaves of *Garcinia somalensis*, November 1913, at Lough, where the host goes by the name of " Ferrandi tree " ; (5) *C. Piceus* Malen. n. sp. very numerous on leaves of *Cassine Schweinfurthiana* (?), called by the natives " Calangcal ", at Aden Caboba, October 1913; (6) *Pseudaonidia quadriareolata* Malen. n. sp., on the bark of *Acacia Asak* at Allengo, September 1913; (7) *P. articulata* (Morg.) ( = *Selenaspidus articulatus* Morg.), on leaves of *Xylocarpus obovatus* at Djumbo, near the mouth of the Djouba, and on leaves of *Salvadora persica*, June 1913; (8) *Hemiberlesia fissidens* (Ldgr.) var. *constricta* Malen, n. var., on leaves of *Rhizophora mucronata* at Djumbo, near the mouth of the Djouba, 13th June 1913, and on leaves of *Hyphaene pyrifera* Beccari with *Chionaspis pseudo-nivea* Malen, n. sp. on the shore of El. Saï, 21st June 1913 ; (9) *Parlatoria* (*Websteriella*) *blanchardi* (Targ.) on date palms, at Merca, 6th June 1913 ; (10) *Dinaspis reticulata* Malen. n. sp., on leaves of *Dobera Macalusoi* at Quambatti, November 1913 and on both leaf faces of an undetermined member of the Capparidaceae, at Mallable, 28th July 1913 ; (11) *D. reticulata* var. *minor* Malen. n. var., on both leaf faces of *Balanites somalensis* near Matagassile, 24th September 1913 ; (12) *D. berlesei* Malen. n. sp., on the under surface of the leaf of a member of the Capparidaceae, perhaps of the genus *Cadaba*, at Biobahal, on the Djouba, 26th September 1913 ; (13) *Chionaspis usambarica* Ldgr., on the under surface of the leaves of *Xylocarpus obovatus* at the mouth of the Djouba, September 1913; (14) *C. elongata* Green, on the under surface of the leaves of *Cassine Holstii*, near Djcumbo, 12th June 1913 ; (15) C. *pseudo-nivea* Malen. n. sp. on leaves of *Hyphaene pyrifera*, with a

number of individuals of *Hemiberlesia fissidens* (Ldgr.) var. *constricta* Malen., on the shore of El Saï. 21st June 1913 ; (16) *C. paolii* Malen. n. sp., on the leaves of *Mariscus chactophyllus* at Bour-Meldac, 23rd July 1913 ; (17) *Lepidosaphes* (*Coccomytilus*) *somalensis* Malen. n. sp., on the trunk bark of *Acacia Asak* with *Pseudaonidia quadriareolata* Malen., at Allengo, September 1913.

825 – **Some Miscellaneous Economic Insects found in New Jersey.** — Weiss Harry B., in *The Canadian Entomologist*, Vol. XLIII, No. 4, pp. 141-143. London, April 1916.

*Callopistria floridensis* Guen. ("Florida fern-cutworm"). — This insect, a lepidopteron already recorded by the Author as doing considerable damage to ferns in greenhouses, was found to be effectively controlled by spraying with fresh pyrethrum, one ounce to one gallon of water, plus one half ounce of soap. Also applied with a bellows with similar results.

*Phytomyza chrysanthemi* Kowarz ("Chrysanthemum leaf miner" or "marguerite fly"). — This insect does considerable damage to chrysanthemums in various greenhouses in northern New Jersey. The larvae mine the leaves. Nicotine solutions are effective against this insect, in place of the more or less unsatisfactory method of picking off and destroying infested leaves.

*Oberea tripunctata* Svederus ("dogwood twig-girdler"). — This coleopteron causes withering of the leaves of *Cornus florida* at the tip of the infested shoot. It is widely distributed in New Jersey, but as a rule does not occur in sufficient numbers to do any considerable damage.

*Hemichionaspis aspidistrae* Sign. — In many fern houses in New Jersey this scale insect is a dangerous pest. It is also continually introduced on Aspidistra plants imported from Belgium. There is no satisfactory remedy, and infested leaves are usually pulled off and destroyed during repotting or turning over the stock.

*Isisoma orchidearum* Westw. ("Cattleya fly"). — This Chalcid, known as the Cattleya fly, deposits one or more eggs in the buds of Cattleya, and development and pupation take place inside. The pest is found in practically all orchid houses of New Jersey where Cattleya species are grown, and is also continually introduced in orchids imported from South America. Fumigation with nicotine extracts is recommended to kill the adults.

*Aphrophora parallela* Say and *Cecidomyia resinicola* O. S. — Observed on pine trees in nurseries, but no injuries to the trees could be detected.

*Corythuca arcuata* Say. This lace bug is found on the leaves of oaks and other trees in various parts of New Jersey.

826 – ***Diplogaster labiata* n. sp. and *D. aerivora* n. sp., Nematode Parasites of *Saperda tridentata* and *Leucotermes lucifugus*, in Kansas.** — Merril J. H. and Ford A. L. in *Journal of Agricultural Research*, Vol. VI, No. 3, pp. 115-127, Fig. 1-3. Washington D. C., April 17, 1916.

MEANS OF PREVENTION AND CONTROL

A description of the life cycle and habits of two new nematodes *Diplogaster labiata* and *D. aerivora*, found as parasites of *Saperda tridentata* Oliv. ("elm borer") and of the white ant *Leucotermes lucifugus* Rossi.

*D. labiata* lives in the digestive canal of *Saperda*. The numbers present therein are so large that the walls of the intestine are broken, the abdominal cavity is invaded, and the death of the insect caused.

The individuals of *D. aerivora* live as parasites in the cephalic region of *Leucotermes*; they are more numerous in the neighbourhood of the mouth parts. Their number ranges from 1 to 75 per insect.

Experiments undertaken in order to ascertain whether the nematodes can be introduced into the body of the *Leucotermes* and produce the parasitic affection artificially gave positive results. White ants brought into contact with cultures of nematodes in wet soil were infected and died in 12 days.

827 – **The Efficacy of *Aphelinus silvestrii* in Control of *Chrysomphalus dictyospermi*, in Sicily.** — De Gregorio A. in *Nuovi Annali di Agricoltura siciliana*, Vth year, VIth Series, Part I, pp. 18-19. Palermo, January-March 1916.

In confirmation of his previous observations (1) the writer reports that in the neighbourhood of Palermo he observed so considerable an increase of *Aphelinus silvestrii* that the latter almost completely destroyed the famous citrus scale insect *Chrysomphalus dictyospermi* for which he proposed the new name of *Aspidiotus agrumincola*. This scale insect has not yet entirely disappeared, but the hymenopteron, its natural enemy, has reduced it so such an extent that it no longer causes injury to the plants or their fruits.

828 – **Efficacy of Various Arsenical Preparations in Control of Insect Pests.** — Battail J. in *Le Progrès agricole et viticole*, 33rd year, No. 19; pp. 448-452. Montpellier, May 7, 1916.

The arsenic salts most in use as insecticides are: sodium arsenate, calcium arsenate, lead arsenate, copper arsenite, iron arsenate and copper arsenate. Their toxic action is in proportion to their content of arsenic. We have therefore:

| | | |
|---|---|---|
| Calcium arsenate | 37.9 % | of arsenic |
| Lead " | 16.7 " | " |
| Anhydrous sodium arsenate | 36.0 " | " |
| Copper arsenite | 34.5 " | " |
| Iron arsenate | 33.6 " | " |
| Copper " | 32.0 " | " |

This scale of values, however, is slightly modified in practice for several reasons, the chief of which are: the solubility of the arsenic salt, the formation of salts which act as though they were impurities and lower the percentage of arsenic in the compound, the presence of chlorides, and the addition of Bordeaux mixture for the purpose of controlling mildew at the same time.

Sodium arsenate is the most soluble, but its action is transitory, and it may seriously burn the green parts of the plants as soon as the dose of 1 per 1000 is exceeded; it is therefore only used in the preparationof the other arsenical compounds.

Calcium arsenate is the richest in arsenic and is also the most effec-

(1) See *B.* April 1915, No. 151. (*Ed*).

tive in application. It is obtained by the reaction of milk of lime on a solution of sodium arsenate, viz :

$$416 \text{ gm } [2Na_3 AsO_4] + 222 \text{ g } [3Ca(OH)_2] = 398 \text{ g } [Ca_3(AsO_4)_2] + 240 \text{ g } [6NaOH].$$

The result is 398 grams of arsenate of calcium and 240 grams of soda or 638 gr. of substances containing in all 150 gr. of arsenic, or 23.5 %.

The presence of the soda, which remains adhering to the leaves after evaporation, therefore reduces the toxic value of the compound 38 % $\left(\frac{23.5}{37.9}\right)$.

For the rest, a large proportion of the soda may be allowed to settle at the time of preparation, and if care is taken to use an sodium arsenate absolutely free from chlorides, the calcium arsenate will be superior to all other preparations of arsenic. The most suitable proportions are : 500 gr. of sodium arsenate and 200 gr. of fat lime or 380 gr. of calcium hydrate.

In arsenate of lead the toxic property of the arsenic is added to that of the lead, so that its insecticidal action is in no way inferior to that of arsenate of calcium, but it is much dearer and much more difficult to prepare. It is obtained by allowing a solution of lead acetate to react on sodium arsenate. The percentage of arsenic in the product is 10 %.

The copper arsenite is obtained by allowing trisodium arsenite to react on a solution of copper sulphate; the content of arsenic in the product is 17.4 %.

Finally, iron arsenate and copper arsenate are obtained by causing sodium arsenate to act on a solution of iron sulphate or sulphate of copper; the percentage of arsenic in the product is 17.2 and 16.9 respectively. In spite of the impurities which form in the preparation of the mixtures, calcium arsenate is therefore much more active in proportion than all the other preparations of arsenic.

The presence of chlorides weakens the properties of the insecticides. These chlorides may very well be contained not only in the arsenate of sodium, but also in considerable quantities in water, especially in well water (2.5 to 3 gr. per litre). It is therefore preferable to use running water as far as possible.

To the arsenical preparation Bordeaux mixture is often added, reducing its toxic action. In a 1 % mixture the weight of the precipitated hydrate of copper oxide is 385 grams per hectolitre; on the other hand, the arsenical mixture obtained with milk of lime and separated from the sodium water contains 398 gr. of arsenical precipitate with a content of arsenic of 37.9 % (150 gr.). By mixing the two precipitates, a total weight is obtained of 783 gr. with only 19 per cent of arsenic.

829 – **The Efficacy of Hot Water Treatment against "Cochylis and "Eudemis„.** — Topi Mario in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, 5th Series, Vol. XXV, 1st Half Year, Part 7, pp. 524-528. Rome, April 2, 1916.

M. Semichon, who proposed this treatment, declared it effective against the eggs and larvae of *Conchylis ambiguella, Polychrosis botrana* and *Sparga-*

*nothis pilleriana*; against aphids, fungi with external mycelium (oidium) and the external fructifications of the fungi. The writer's experience was confined to the summer generation of *Conchylis* and *Polychrosis*, especially their eggs. Experiments were carried out both in the fields and the laboratory, chiefly with water at 55°-56° C. The results obtained lead to the conclusion that the proposed sprayings with hot water only, at such a temperature that it cannot injure the plant (1) are almost entirely ineffective against the eggs of *Polychrosis* and *Conchylis*. The effectiveness against the larva is very doubtful. In any case they could hardly be reached, being sheltered in the floral buds or even inside the grapes. Only an immersion for 10 minutes in water at 65° C. (probably even only at 55°), is found sufficient to sterilise the eggs. It does not appear possible to make any practical application of this result.

830 - **Bridge Grafting for saving Fruit Trees with Injuries due to Animals or Mechanical Causes.** — See *No.* 758 of this *Bulletin*.

INSECTS INJURIOUS TO VARIOUS CROPS

831 - ***Triaenodes bicolor* and *Hydrocampa nymphaeata* in the Rice Fields of the Province of Milan, Italy.** — SUPINO F. in *Rendiconti del Reale Istituto Lombardo di Scienze e Lettere*, Series II, Vol. XLIX, Parts II-III, pp. 108-114. Milan, 1916.

The study carried out in the rice fields of the environs of Milan in relation to the aquatic larvae which, according to farmers, caused more or less injury to rice, proved the existence of three different insects: *Stratiomys chamaleon* L., an absolutely harmless dipteron, and two injurious species, *Triaenodes bicolor* Curt. and *Hydrocampa* (*Nymphula*) *nymphaeata* L.

*Triaenodes bicolor* (order Neuroptera, sub-order Trichoptera, family Leptoceridae). — The larva of this insect cuts the leaves of aquatic plants for use as a sheath or cover and in the rice fields uses the rice leaves for that purpose, partly destroying them.

*Hydrocampa* (*Nymphula*) *nymphaeata* (order Lepidoptera, family Pyralidae, sub-family Hydrocampinae [Nymphulinae]). — This is one of the rare lepidoptera the larvae of which live in water; this larva also cuts the leaves to make a sheath for itself; but what is more important and renders it more injurious than that of the *Triaenodes*, is that it attacks not only the rice leaves, but also the young plants, feeding on them.

For control, it is advised to put carp in the rice field. They destroy a large number of the larvae, as was ascertained several times with certainty.

832 - ***Tychius quinquepunctatus*, a Coleopterous Pest of Beans in Apulia, Italy.** — G. GRANDI, in *Bollettino del Laboratorio di Zoologia generale ed agraria della R. Scuola superiore d'Agricoltura in Portici*, Vol. X, pp. 103-119, Fig. 1-6. Portici, March 18, 1916.

In April 1915, there was an extensive invasion of *Tychius quinquepunctatus* L., in the bean fields of the commune of Ruvo di Puglia. The adults feed on the parenchyma of the soft leaves and young pods of the bean. Mating occurs in the first half of April, and the females oviposit in a hole or tunnel previously bored with their rostra in the wall of the pod. As soon

(1) Tests have shown that on thoroughly wet leaves with water at 65°C., burns are produced on the young and even on the adult leaves. (*Ed.*)

as the larvae hatch they gnaw away the outer seed cover, and through the caruncle or at any point of the seed they enter the cotyledons which they gnaw and crush easily with their strong biting jaws. The injury they thus cause is very serious, and in the case of extensive infestations the loss may be 50 % or even 75 % of the entire crop.

Unfortunately no natural enemies of this member of the *Curculionidae* are yet known. Resort must therefore be had to artificial means of control Among the most effective there are recommended : 1) disinfecting the ground by injections of carbon disulphide ; these injections must be made immediately after the crop, to the amount of 30 to 50 cc. of liquid per square metre ; this destroys the larvae and pupae, but care must be used and the necessary precautions taken in the neighbourhood of any trees ; 2) bean cultivation should be replaced by some other for some years; this is advisable when feasible economically, and may be made so if all the farmers of the region without exception arrange to take this step.

833 - ***Ligyrus fossator* and *L. fossor*, Coleoptera attacking Sugar Cane, in Brazil.**
— *Chacaras e Quintaes*, Vol. XIII, No. 4, pp. 248-249, Fig. 1-83. St. Paul, April 15, 1916.

The northern States of the Brazil Union have for a long time deplored the grave injury caused to sugar cane plantations from time to time by coleoptera called " bezouros dos cannaviaes ", sometimes causing destruction of the crop. Dr. CARLOS MOREIRA, chief of the Laboratory of Entomology of the National Museum of Rio de Janeiro, was instructed by the Ministry of Agriculture to study these insects. His researches at Pernambuco proved that the " bezouros " of the sugar cane plantations are numerous, but that the most injurious of all is *Ligyrus fossator* Dejan, the larvae of which, called at Pernambuco " pão de gallinhas " because hens are very fond of them, live in the soil and gnaw all the rooted fragments of cane within their reach. This same parasite of the sugar cane has already been reported in French Guiana.

There are advised as means of control : 1) injections of carbon disulphide ; 2) flooding and subsequent drying of the soil ; 3) turning over the soil and collecting all the larvae by hand ; 4) use of light traps for capturing the adults.

A sure and cheap means for destroying a large of number of larvae is based on the fact that after heavy rains pools of water form in the lower parts of the plantation. The larvae beneath die of asphyxia. When the pool dries up, the larvae gather at its edges in search of moisture. They may then be destroyed in large numbers by burning straw at the point where the moisture has barely disappeared. In order to destroy the larvae farther away from the surface, the ground must be flooded or watered with distillery residue, or carbon disulphide injected.

At Allagoas the sugar cane is also injured by another coleopterous insect *Ligyrus fossor* Latr., which is controlled in the same way.

The sugar cane is also attacked by scale insects which live on the culm, chiefly beneath the leaf sheaths, and which cause extensive damage when they get near to the rooted cane fragment or pass into the roots. To destroy

these parasites a piece of cane must, before planting, be steeped in a solution of calcium sulphide of 5° Beaumé strength or a 2 % emulsion of soap and kerosene, for 15 minutes.

834 - **The Leopard moth (*Zeuzera pyrina*), a Dangerous Imported Insect Enemy of Shade Trees in the United States.** — HOWARD L. O. and CHITTENDEN F. H. in *United States Department of Agriculture, Farmer's Bulletin* 708, pp. 1-10, Fig. 1-4. Washington, D. C. February 14, 1916.

In the Hudson Valley and on the Atlantic seaboard, from Massachusetts to New Jersey, shade and ornamental trees and shrubs of many kinds, with the exception of evergreens, are severely injured by the larvae of the lepidopteron *Zeuzera pyrina* Fab. (*Z. aesculi* L., *Z. decipiens* Kirby), a European species accidentally introduced a short time since in the United States.

These larvae mine long tunnels in the living wood and stop growth to such an extent as to cause the death of the plant, especially in young trees.

In any case the presence of these tunnels weakens the trees, so that they are less able to withstand wind pressure, and also opens a path for other insects or germs of the most varied diseases.

The trees attacked are not only the horse chestnut, chestnut, walnut, oak, maple, alder, birch etc., but also fruit trees, such as pear, apple and plum trees, etc.

Some birds and mammals are among the most effective natural enemies of these insects.

Artificial means of control : 1) cutting and destroying the infested wood 2) injecting carbon disulphide into the tunnels bored and afterwards blocking up the apertures very carefully; 3) lighting very bright fires in those parts where the insects abound; the pests will be attracted by the light and fall into specially arranged pans filled with water and petroleum.

835 - ***Pseudococcus citri, P. bakeri, P. citrophilus* and *P. longispinus* in the Citrus Plantations of Southern California.** — CLAUSEN CURTIS P. in *Agricultural Experiment Station, Berkeley, California*, Bulletin No. 258, pp. 1-48, 8 Fig. Berkeley, 1916.

Four species of *Pseudococcus* : *P. citri* Risso, *P. bakeri* Essig, *P. citrophilus* Clausen Mss. and *P. longispinus* Targ. are particularly injurious to citrus trees in Southern California, especially in the seaboard region, where the moisture and heat conditions favour their growth. On the other hand the outbreaks become more and more sporadic and rare in the interior.

(1) *P. citri* Risso. — First reported in 1880 in the county of San Diego, whence later on it spread into the countries of Orange, Los Angeles, Ventura and Santa-Barbara. Owing to the considerable quantity of the juices which the adults take from the young branches and fruits, many leaves fall, and the fruits discolour and are very tardy in growth. At the time of flowering the insect frequently causes fall of the leaves and the barely set fruit. The larvae likewise occasion extensive havoc. They extract the sap and chlorophyll from the leaf cells and secrete a large quantity of honeydew, thus occasioning the appearance of a rich cryptogamic vegetation (*Meliola Camelliae*) The latter clogs up the apertures of the stomata, which hinders the functions of the leaves.

The principal hosts of *P. citri* are *Asparagus officinalis* ; *Strelitzia gigantea* (bird of paradise flower) ; *Callistemon lanceolatus* (bottle brush) ; *Bouwardia* sp. ; *Umbellularia californica* (California laurel) ; *Cestrum* spp. ; *Citrus medica* var. *genuina* ; *Coffea arabica* ; *Coleus Blumei* ; *Columbium* sp. ; *Gossypium peruvianum* ; *Geranium* sp. (cranesbill) ; *Cucumis sativus* ; *Ceanothus integerrimus* (deer brush) ; *Cordyline terminalis* ; *Hedera Helix* ; ferns ; *Fuchsia* sp. ; vine ; *Passiflora edulis* ; Jasmin ; *Plumbago* sp. (leadwort) ; lemon tree ; magnolia ; *Ipomoea Bona-nox* (moonflower) ; nettle ; *Solanum Douglasii* (nightshade) ; *Nerium Oleander* ; orange tree ; *Panax monstrosa* ; *Paeonia* spp. ; *Solanum muricatum* ; *Phyllanthus carolinensis* ; *Euphorbia pulcherrima* ; *Citrus decumana* (pomelo) ; potato ; *Solanum jasminoides* ; gourd ; *Passiflora violacea* ; *Sequoia sempervirens* (redwood) ; *Begonia* sp. ; *Tacsonia jasminoides* ; tobacco ; *Cyperus alternifolius* (umbrella plant) and *Zebrina pendula* (variegated wandering Jew).

(2) *P. bakeri* Essig. — Was first discovered on *Sambucus glauca* (elder) in the neighbourhood of Santa Paula, county of Ventura, whence it made its way into the counties of Santa Barbara, Los Angeles, Orange, San-Diego, Riverside and San Bernardino.

The injuries it occasions are the same as those of *P. citri*. The larvae and adults attack by preference the tender leaves full of sap, where they gather in numerous colonies.

Hosts : apple ; *Aesculus californica* (buckeye) ; *Umbellularia californica* ; *Aleurites triloba* (candlenut) ; *Agave americana* ; *Coleus Blumei* ; *Cestrum* sp. ; *Cordyline terminalis* ; *Sambucus glauca* ; ivy ; *Enterolobium* sp. ; *Erigeron canadensis* (horseweed) ; Iris ; *Cydonia japonica* ; lemon tree ; *Lilium Parryi* (lemon lily) ; *Phaseolus lunatus* (Lima bean) ; *Choisya ternata* (Mexican orange) ; nettle ; *Solanum Douglasii* ; orange tree ; pear tree *Solanum jasminoides* ; *Salix* sp. ; *Helianthus annuus* ; walnut ; *Grevillea robusta* (silk oak).

(3) *P. citrophilus* Clausen Mss. — First appeared in 1913 near Uplands, county of San Bernardino. Was mistaken for *P. citri*, causing much anxiety to the local fruit growers. The injury it causes is never serious. It may at most occasion the fall of some flowers or young fruits of the lemon tree and discolouring of the orange tree fruit, but always to a very limited extent.

Hosts : *Azalea* ; *Rubus villosus* ; *Ficus pumila* (climbing fig) ; fig tree ; ivy ; heliotrope ; lemon tree ; orange tree ; mallow ; *Choisya ternata* ; *Brassica nigra* ; *Solanum Douglasii* ; *Schinus Molle* (pepper tree) ; *Chenopodium album* (pigweed) ; walnut ; *Melilotus alba* ; potato ; *Rubus nutkanus* ; rose bush ; rhubarb ; *Lolium perenne* ; *Grevillea robusta* ; *Helianthus annuus*. All these plants are not equally frequented. The presence of *Ps. citrophilus* is rather rare on some of them. Others, however, such as the potato, rhubarb and *Grevillea* are more often attacked than citrus plants.

(4) *P. Longispinus* Targ. — Common throughout Southern California, in the counties of Santa Barbara, Ventura, Los Angeles, Orange and San Diego.

Hosts : *Begonia* spp. ; *Strelitzia gigantea* ; *Richardia africana* (calla) ;

*Aleurites triloba* ; *Agave americana* ; *Cineraria cruenta* ; *Citrus medica* var. *genuina* ; *Coleus Blumei* ; *Epiphyllum* spp. (crab cactus) ; *Croton Tiglium* ; *Cordyline terminalis* (dracaena) ; ferns ; fig tree ; *Flacourtia sepiaria* ; *Fuchsia* spp. ; *Erythea edulis* (Guadeloupe island palm) ; *Psidium Guajava* (guava) ; lemon tree, mango tree ; *Ipomoea Bona-nox* ; *Nephrodium amplum* ; *Nerium Oleander* ; *Opuntia* spp. ; *Phormium tenax* var. *variegatum* ; plum tree ; *Cycas revoluta* ; *Platycerium* spp. ; *Stangeria schizodon* ; *Sterculia Gregori* ; *Cyperus alternifolius* ; *Zamia* spp. Chiefly tropical and subtropical species introduced into California as ornamental plants.

*Cordyline terminalis* (dracaena) is chiefly injured by the adults, which sometimes gather in large numbers on the terminal buds and prevent growth.

Among the natural enemies of these species of Pseudococcus in California, there are : 1) *Sympherobius californicus* Banks (brown lacewing); the female lays its eggs on the leaves and the fruits of the infested citrus plants, and the larvae emerging, like the adults, destroy a large quantity of *Pseudococcus* ; 2) *Leucopis bella* Loew, the only really effective natural enemy of *P. citrophilus* ; 3) *Cryptolaemus montrouzieri* Muls. : spreads very slowly and with difficulty, and can only live in a few very limited coast localities where it finds the conditions of moisture and temperature needed for its growth ; 4) *Chrysopa californica* Coq. (green lacewing) : its larvae attack the larvae and adults of *Pseudococcus* ; 5) *Scymnus guttulatus* Lec. and *S. bipunctatus* Kugel : the latter was import ed from the Philippines in 1910 and is now found in the counties of Ventura and Santa Barbara ; 6) *S. marginicollus* and *S. sordidus* Horn : the latter is the most effective species of *Scymmus* in controlling *Pseudococcus* ; 7) *Chrysoplatycerous splendens* How., introduced from the Philippines into the county of San Diego and at present spread throughout Southern California.

Fumigation with hydrocyanic acid, and applications of various antifungus preparations, may give good results, but the best have been obtained by simple jets of water under high pressure at the rate of 44 to 66 gallons of water per plant.

836 – **The Woolly Whitefly (*Aleurothrixus Howardi*) in Florida Citrus Plantations.** — WATSON J. R. in *University of Florida, Agricultural Experiment Station*, Bulletin No. 126, pp. 81-102. Tallahassee, Fla., 1915.

*Aleurothrixus howardi* Quaintance, which was very probably imported from Cuba, was discovered for the first time in Florida in the neighbourhood of Tampa, in the autumn of 1909. In 1914 it had already reached the counties of Hillsborough, Pinellas, Manatee, Polk and De Soto, and will soon end in becoming common in all the citrus plantations of Florida.

*Aleurothrixus* causes damage in three ways to the plants attacked 1) removal of juice from the tissues, causing the withering of the plant 2) secretion of a honeydew which covers the leaves and fruits and forms a good medium for the growth of *Meliola Camelliae* and other fungi hindering the functions of the leaves and rendering washing of the fruit necessary ; 3) the colonies of *Aleurothrixus* are a centre of attraction for the " purple scale " (*Lepidosaphes beckii*) so injurious to citrus plants.

Among natural enemies, "red fungus" (*Aschersonia Aleyrodis* Webber) and "brown fungus" (*Aegerita Webberi* Fawcett) grow badly on the *Aleurothrixus* and certainly cannot prevent its spread. The writer found on some dead larvae a *Cladosporium* (in the proportion of 80 %) which he considers to be the direct cause of their death, although he was not able to verify his hypothesis by inoculating living larvae with pure cultures.

The most effective and active natural enemy, however, is undoubtedly a small hymenopteron (*Eretmocerus haldemani*) the female of which lays its eggs in the body of the larvae or pupae of *Aleurothrixus*. The latter are then killed by the larvae hatching out of the eggs in their bodies.

As regards artificial means of control, good results are obtained by applying oily mixtures in the early days of March, the first half of June, about the middle of August and the beginning of November, when the parasites are in their early stages of development and more sensitive to insecticidal action.

The following formula is advised: to 8 lbs. whale oil soap add 2 galls. of fine paraffin oil, stirring vigorously all the while so that the whole is well emulsified. Add 1 gall. of water to the emulsion, stirring as before. Dilute emulsion to make 200 galls. of spray solution.

837 – ***Icerya purchasi* in Florida, United States.** — WATSON I. R. in *University of Florida, Agricultural Experiment Station, Report for* 1914, p. 55. Tallahassee, Fla., 1916.

*Icerya purchasi* has continued to spread with continually greater rapidity. From August 1913 to March 1914, it was discovered in the following localities: St. Cloud, Key West, Odessa (Pasco County), Terra Ceia Island, Palmetto, Leesburg, Tavares, Ashton and Narcoosee.

The damage has been very serious, especially at Key West, where *Icerya* even attacks *Bursera Simaruba* (gumbo-limbo). This plant must be added to the list of hosts of this scale insect.

838 – ***Bombyx Pini*, a Spanish Pest of Pine** (1). — MIRA JENARO in *Revista de Montes*, XLth year, No. 940, pp. 193-202, Madrid, March 15, 1916.

Reference is made to the extensive damage caused by *Liparis processionea* and *Bombyx pini* in the pine forests of the "Dehesa de la Albufera"; the particulars given chiefly concern the latter insect.

Many trees entirely defoliated perished rapidly, especially in hot and moist regions where transpiration is more intense.

The control of the insects was undertaken by means of active and well organised measures, owing to which, by the resort to every available means, an enormous quantity of adults and larvae were destroyed, thus saving a considerable number of pines from certain destruction.

The following were the most effective means used:

1) Direct control by removal and destruction of the nests of the insects; hanging out white cloths at night, covered with a sticky substance and strongly illuminated; the adults, attracted by the light, are caught on the cloth;

(1) See also *B.* Jan. 1916. No. 136. (*Ed.*)

2) Spraying on the youngest, which are the easiest to get at, arsenate of sodium and quicklime, which safeguards the plants against further attacks (arsenate of sodium, 10.5 to 12.2 oz ; quicklime, 2.2 lbs ; water 22 galls.) ;

3) Coating the pine trunks over a more or less extensive area with a sticky pitch substance. The larvae coming down from the tree and those climbing up in search of food stop in front of the coated belt and can easily be destroyed. This is a very practical and easy method of control.

839 - ***Lyda hypotrophica*, a Hymenopterous Pest of Epicea in the Forests of Roggenburg, Germany.** — Parts in *Zeitschrift für angewandte Entomologie*, Vol. 3, No. 1, pp. 75-96. Berlin, March 1916.

A very detailed description is given of the occurrence of *Lyda hypotrophica* Htg. (= *Cephaleia abietis* L.) in the forest of Roggenburg (Suabia) and the damage it has occasioned of recent years. These data are based on observations made in the Royal Forest District of Breitenthal, but they are so characteristic that they may be considered as being likewise typical for the whole of Suabia.

In August 1911, in a stand of epicea 119 years old, in the southeast part of the said forest, many trees were remarked with their tops and side branches entirely stripped of needles. This fact was at first put down to the excessively dry weather in that year, but on felling some trees later, it was found to be caused by injury due to *Lyda hypotrophica*. In the month of September following, all the stands attacked where the insect was likely to be sheltered were studied, and the quantity of larvae contained in the soil was determined in 323 plots of 1 square metre each distributed over different points. It was found, in accordance with the literature of the subject, that stands of 60 to 120 years had suffered most, both with regard to infested area and number of larvae.

The chief object of these experiments was to determine how widespread was the occurrence of the insect in the forest. As however the majority of the larvae generally live in that part of the soil which is shaded by the largest trees, the latter were almost exclusively used for the experiments. The result is that this method only supplies maximum figures as to the presence of the larvae.

When in 1912 the Writer took over the management of the forest district of Breitenthal, he hastened to obtain average figures as to the presence of larvae in the soil. He not only selected the plots in all parts of the forest, but he more than trebled their number. This was the more necessary inasmuch as the first experiments had exhibited great variations in the number of larvae, even per unit of shaded area. There had been found in one district 2083 larvae per square metre of shaded area, while in another the number was only 480.

These experiments have shown that no stand throughout the total extent of the Royal forest district comprising 5683 acres was free from larvae, independently of the age of the trees. One stand alone showed an increase in the average number as compared with 1911 ; generally this num-

ber in the different districts was below that of 1911. The reduction was at first put down to exceptional circumstances.

In order to secure exact data, the experiments were continued in the spring of 1913, on the same number of plots as in 1912. The number of larvae had again diminished.

The results obtained in the autumn of 1911, in March and April 1912, and in March 1913 for all the stands showing 200 or more larvae on the area shaded by one tree were compared with each other.

It was found that taking as a basis the number of larvae found in 1911=100, this number had fallen off 19.5% for the spring of 1912 and 47.5% for the spring of 1913.

From this it is evident that the number of larvae decreased in the course of the year observed by the Writer.

Control measures were only undertaken in 1913; therefore the reduction was due to natural factors. LANG has shown that in the forests of Upper Franconia, the larvae of *Raphidia ophiopsis* can attack the eggs and young larvae of *Lyda*. Yet the reduction in the number of *Lyda* could not be put down to this enemy, as it was only rarely found in the excrement of the insect. Traumatic causes, such as injury to the larvae, were also not responsible for the reduction in number. Nor were there more parasites, as it was observed in 1912-1913 that a large number of larvae shut up for several weeks contained only a small number of ichneumonidae. The Writer however, at the end of 1914, found ichneumonidae in some parts of the forest in no less numbers than the *Lyda* flying in June. The outbreak of war however prevented him from ascertaining whether these ichneumonidae were connected with the appearance of *Lyda*. Quite possible there is a connection, as BAER claims to have observed that the ichneumons (*Polycinetis aethiops*) attack the almost full-grown larvae of *Lyda*.

The damage caused by *Lyda* to the epicea population of the forest of Roggenburg was very great, but not sufficient to bring about the death of the trees. The tops which were bare the spring of 1912 regained their greenness, and in the following year the damage had to a great extent disappeared. Only the branches in the lower part and interior of the tree top, where the sunlight is very feeble, retained their bare appearance. Other circumstances, such as the presence of a large number of *Bostrichids*, were not observed. It was likewise not possible to determine to what extent the growth of the trees had suffered through the influence of the insect. The increase in size depends primarily on the length of time during which the insect carried out its destructive work. It is generally supposed that the larva destroys the needles during June, July and the beginning of August and afterwards shelters in the ground. It is pointed out that this observation is only partly correct. There are some larvae which remain longer on the tree than others. In one case, the Writer observed that certain larvae continued to destroy the needles right up to December.

For effective control of *Lyda* it is essential to know in good time when they will fly. On the occasion of the flight in Upper Franconia it was observed that the larva of *Lyda* undergoes no external change before con-

version into a pupa. The skin of the larva only shrank a few days before it burst. It is pointed out that these changes were never observed by the Author, though he studied thousands of larvae. More precise indications on this question were given by SCHEIDTER, who found that the larvae which have attained complete maturity show deep black oval spots above the eyes, visible to the naked eye, which represent the eyes of the future pupa ; they are called " Puppenaugen " (pupal eyes ). In the months of April, May and June 1913, on the basis of this character there were examined 11 800 larvae from 8 different stands, and the number of those ready for transformation into pupae determined. It was found that this criterion is only partly correct. " Pupal eyes " do not appear only before conversion into pupal form, but as early as the previous autumn or summer. The larvae were found with pupal eyes in the month of August 1913.

This fact is important in practice, as by its aid it may be determined in the autumn whether or not there will be a great flight of *Lyda* in the following spring.

While observing the evolution of larvae into pupae the writer also ascertained the number of pupae in the above stands. Within a few weeks alone he found great variations in the number, which variations occurred at all points at the same time. The cause is probably the weather, which exerts an influence on the transformation. A high temperature in April is found to favour the formation of pupae.

The perfect insect emerges very early from the soil, the emergence appearing also to be related to the weather. If the weather is rainy and foggy, only a small number of adult insects are found, while on fine days they come out in large numbers. According to the writer mating generally takes place on the ground, on the leaves of *Gramineae* and very rarely in the crown of the tree.

With regard to *Lyda* control commenced in the forest of Roggenburg, the Author remarks as follows ; glue bands at a height of about 5 feet above the ground proved very successful at the beginning of flight. The female insects rarely reach the summit flying, most of them climbing up the tree.

Later on, when the weather allowed the insects to emerge in large numbers, and the ovaries of the females were full of eggs, the females traversed the band of glue without being captured. This observation is in contradiction with those of many investigators, and therefore the studies should be continued. The writer also made experiments with fly-papers and obtained excellent results. The high cost of this method of control however prevented him from repeating the experiments on a large scale. In any case they showed that a substance must be used with the properties of the glue used for catching flies if it is desired to obtain good results with glued bands or strips for controlling *Lyda*.

ALFREDO RUGGERI, *gerente responsabile*.

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

# INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

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The Bureau assumes no responsibility with regard to the opinions and the results of experi iments outlined in the Bulletin.

The Editor's notes are marked (*Ed.*).

FIRST PART.

# ORIGINAL ARTICLES

## Industrial Retting of Textile Plants by Microbiological Action

by

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The search for a *retting method based on bacterial action* is due largely to the defects existing in the methods commonly used in rural districts, and also to the deficiencies in the chemical methods by which it was sought to replace them.

The many chemical methods (all reducible no doubt to a single type and aiming solely at dissolution of the interfibrous substances by means of a reagent, the excess of which is afterwards neutralised and disposed of without injury to the fibres themselves) are by the very conditions of the problem incapable of yielding very satisfactory or constant results, for two main reasons, one based on the anatomical nature of the textile fibres, and the other on their chemical composition.

The anatomical impediment lies in the fact that all the stalks the fibres of which are to be separated are not of quite the same age, and the fibres are consequently not of the same thickness.

Therefore the quantity of intercellular matter to be dissolved likewise cannot be the same in every respect.

Hence, there may be an excess or deficiency of reagent, but this would not matter, as the easiest course, that of an excess of reagent, might likewise be adopted. This method might be adequate if the impracticability of devising a specific reagent for the intercellular substances, *i. e.* one which would attack the pectic materials exclusively without occasioning any injury whatever to the cellulose of the fibres, did not render the successful application of chemical methods impossible.

From the basis of our knowledge of the macrochemistry and microchemistry of the intercellular substances it appears impossible to devise

this specific reagent. It may be contended that in view of the affinity between pectic substances and carbohydrates any reagent attacking the former strongly must necessarily attack the latter, at any rate slightly. If in order to surmount this difficulty an insufficient quantity of reagent were employed, the resulting separation of the fibres might be insufficient. That is why all chemical means tend to break up the fibre. A similar defect is obviously inherent in ordinary microbiological methods, *i. e.* those practised in rural districts for retting purposes.

In these latter it is not only the bacteria of pectic fermentation which multiply, but also other bacteria, chiefly those of cellulose fermentation. This happens so easily that there is the risk of the fibres being injured in the same way as by the action of a chemical reagent common to the two substances.

If it so happens that specific pectic bacterial ferments develop exclusively, or predominate over the others for some length of time, it may be assumed that microbiological retting will take place without any drawbacks ; but in this case only. Moreover, it is still necessary to stop the retting process by taking the textile materials out of the liquids in which they are steeped when the necessary limit has been reached. This is not always easy, as it is by no means rare for a lot of hemp or flax to be classified as " over-retted ", depreciating markedly in consequence ; the most able peasants may make mistakes in this respect. This being the case, nothing but a ferment, fixed or soluble, specific to the pectic substances, acting in *pure culture* if it is an organism and alone if it is an enzyme, would overcome all the difficulties, because the degree of sensitiveness required for this very special problem can only be obtained from a biological action.

With the help of other workers I showed that there are micro-organisms which attack plant tissues but leave the cells and their derivatives intact. Thus, on preparing a culture of *Bacillus Comesii* in the presence of a leaf of *Medicago lupulina* or *Coronilla Emerus* (sterilised by means of special methods leaving the leaf chemically intact), these leaves are decomposed into 3 parts :

(*a*) the parenchyma cells which fall to the bottom of the medium ;
(*b*) the sclerenchyma, which remains intact in skeleton form ;
(*c*) the epidermis, which floats on the liquid.

This decomposition goes no farther. By preparing a culture of the same bacillus in the presence of wisps of hemp, under the same conditions as the leaves, the dissociation of the stalk into its three parts is secured : wood, textile bast-fibres and cells of the cortical layers. All these parts, however, and what is more important, the fibres, may be kept in the presence of the still living bacteria for as long as 2 years without being attacked and even without the breaking-up of the primary fibre. The cellulose wall thus cannot serve as food material for these bacteria.

All these facts (utilised in the method of retting bearing my name) constitute the *pectic fermentation* referred to above.

The proposed microbiological methods of retting are many, but can be brought under 2 heads : 1) those in which the addition of a selected fer-

ment forms an accessory part ; 2) those in which such addition is the principal part. The process devised by the Institute of Agricultural Bacteriology of Portici, and based on the use of the pectic aerobic ferments already mentioned, the prototype of which is the *Bacillus Comesii* (named after Prof. Orazio Comes), also mentioned above will belong to the 2nd group.

This method consists in : 1) immersing the textile materials in ordinary water ; 2) raising the whole to the *optimum* temperature of the bacillus in question, from 28° to 35° C., which temperature must be maintained during the entire period of retting ; 3) adding a sufficient quantity of pure culture of the bacillus ; 4) passing an air current through the entire mass during the whole period of retting.

Theoretically, the water, the textile material and the vessels should be sterilised, but this cannot be done under practical conditions. The novelty and the very essence of the method in question (as was shown very clearly by the long discussion, with the German Patent Office, which afterwards granted the patent) consists in the fact that the air passing through the mass regularises and intensifies the action of the pectic ferments. The latter can in this way act rapidly as retting agents, and gain the upper hand over all the other microbes present, which remain inactive.

Any water suitable for retting as practised in rural districts is also adapted for the method, and the duration of the operation ranges from 42 to 84 hours, according to the textile material.

The process is very simple and it will be seen that to carry it into practice there are only needed :

(1) Vats, differing very little from those used by peasants, and feed pipes ;

(2) Water for retting the substance, and also if necessary for washing it ;

(3) Heat (steam) ;

(4) Air for retting and drying the textile material ;

(5) Ferments.

As regards the industrial application of this method a distinction must be made, as it is more or less easy to apply according to the material operated on, and each textile fabric calls for the solution of a separate problem in this respect.

*Hemp.* The method of retting under consideration is also applicable to hemp, no matter whether the epidermis remains attached to the hemp stalk, or whether it has first of all been detached from it. If there were no other reason, however, in view of the great difference involved as regards capacity of the retting plant required, it is certain that the two cases offer two altogether different problems.

Where hemp in the stalk is in question, the required plant consists of : vats, a water pipe, boilers for steam production, a motor for compressing air, and also, of course, Decauville engines for conveying the stalks, pumping machinery for supplying and removing water, and better still, an ap-

pliance for mechanical washing of the retted hemp. Drying is carried out in the open air as in ordinary retting.

On the other hand the matter becomes more complicated where the retting is preceded by green scutching. Nevertheless the latter is always preferable, because this system carries with it the following advantages:

(1) If the scutching is done in the field, only about half the weight of raw material will have to be carried to the retting appliance.

(2) During retting, the macerating capacity will be a little more than $\frac{1}{3}$ superior to that of retting as practised in the country districts, hence

(3) The reduction of the bulk to be treated means a reduction of vat area in the proportion of $\frac{2}{3}$.

(4) A reduction of $\frac{2}{3}$ in water consumption.

(5) A reduction of $\frac{2}{3}$ in consumption of heat and air.

Moreover, it is only by scutching first of all that one of the advantages of industrial methods generally, and the one we advocate in particular, can be really turned to account. The methods consists in the following:

(6) The work can be carried out throughout the year. Artificial drying of the stalk would entail enormous expense. Industrial stalk retting is only conceivable during the good season. Precisely the contrary is the case in the retting of the already scutched material, and drying is then one of the easiest operations.

It should also be remarked that these observations on the advantages of scutching before retting presuppose of course that scutching is possible *per se* in the first place, and then in relation to the subsequent retting of the fibres.

It can be proved that scutching is possible, though there are prejudices against it which are chiefly based on the fact that up till now mechanical white scutching or breaking of the retted stalk hemp on the country method is a problem for which no satisfactory solution has been found. There is no mechanical scutcher obviating the necessity of afterward breaking the hemp by machine, or, better still, hand crushing it, or both together. There is also no method which does not leave a considerable quantity of tow and leave the harl very tangled.

On the other hand, there are scutchers capable of reducing from 3 to 6 1 % of the weight of the stalk, according to the quantity of the hemp and which turn out inconsiderable quantities of tow.

These figures prove, it is true, that when scutching is finished, the resulting harl is still made up, to the extent of 50.2 to 46.7 %, and at very least 28.3 %, of stalk, but this is not a drawback, because retting by its very properties as easily effects detachment of the harl from the woody part as do the operations of beating and, above all, washing; finally, however, the drying and softening of the harl, cause the disappearance of all the remaining stalk.

It is true, however, that scutching remains a fairly delicate operation because a given machine is not always adapted for handling all kinds of hemp. It has moreover been found that green scutching is more dis-

advantageous in its results and leaves more stalk adhering, in proportion as the hemp is less dry and the stalk is finer.

As regards the retting of the scutched epidermis, it is quite true that the resulting material differs slightly in appearance from the flax retted in stalks. It is smoother, less divided, more glossy, and above all the strips appear to adhere, but it suffices to put it through a slight process, such as brushing, to render it flexible, as practised in hemp spinning works, in order to get rid of all adhesion and produce an excellent degree of flexibility, division and colour.

Nevertheless it follows from all the foregoing that it would be erroneous to suppose that the method, though admittedly efficient when applied to scutched hemp, may be deemed a simple substitute, though of course cheaper, for the method at present adopted in the country. If this were the case, it would leave unchanged all the other economic relations between the production, the industry and the trade in hemp. This is by no means the case, as the method is destined to bring about a violent change in all those relations, and entails the industrialisation of hemp retting. The hemp grower will be called upon to grow the plant and sell it in the stalks for industrial treatment ; it will be the function of the retting factory to ret the hemp after scutching it, then to comb it, or else to sell it direct to the factory which specialises in combing, spinning and weaving the hemp.

The method, in order to gain footing in the practical treatment of hemp, might encounter difficulties of 3 kinds : prejudices, vested interests, and absence of economic advantages.

We cannot here go into the first or the second of these difficulties, which for that matter are more or less common to all innovations and which are gradually overcome. On the other hand it has beeen necessary to show that difficulties of the third class do not exist. This has been done by methodical official experiments conducted chiefly at Ferrara (Italy) in 1908, afterwards at Mans (France) in 1911, and at Portici (Italy) in 1912. Here it was shown that retting by this microbiological method only takes 84 hours for hemp, without there being any danger of going beyond the *optimum* point of retting ; it does not produce any offensive smell, and in ordinary times the cost per cwt is : 3 *s.* for Italy, 3 *s.* 8 *d.* for France, as against 6 *s.* to 13 *s.* 8 *d.* for retting as practised in the country-side. On the other hand the commercial value which this method gives to hemp may amount to more than 32 % above that obtained on the other system.

With such a practical basis, industrial tests cannot be otherwise than successful, and in France, where special cultivation conditions exist, the Société Française du Rouissage industriel at Mans (Sarthe), a limited company founded in September 1912, will work the patent in France, its Colonies and Protectorates. A few months later the first factory was set up at Bonnétable, in the district of Mamers.

The factory was built for the retting of scutched hemp, and comprises the following principal sections : *Hemp stocks, Decauville light railway* with special trucks for conveying the bundles of hemp to the scutching depart-

ment. *Scutching Department* comprising : a machine for cutting off roots and tops, a drier for the stalks to be scutched, fitted with a boon suction current. *Preparation of cages of scutched hemp* and *hoist* for conveyance to the retting department. *Retting Department*, comprising a battery of 4 vats of 19.62 cu. yds. capacity each, divided into sub-vats 3ft 3in wide and 16ft 3in deep, furnished with a special arrangement for supplying steam, water and air. *Washing and Pressing Department*, containing washing machines and *centrifugal driers*. These different sections are connected with each other by overhead rails with points, for the conveyance of the cages containing the material for retting and that already retted. From the washing section a hoist runs to the *drying department* (with automatic apparatus supplying a current of hot air). There is also a *special department for the producion of ferments*, which is fitted with an automatic producing device.

After a starting period which occupied 2 months, the whole of this plant was in regular operation, and the Chairman of the Company wrote in March 1914 that, to their great satisfaction, the shareholders had been able to satisfy themselves of the following:

(1) The production of ferments by means of cultures supplied by our laboratory had always proved very regular and easy.

(2) The retting of the hemp was regularly completed in 48 hours.

(3) The yarns obtained by the *Société textile Alençonnaise* with the hemp retted on our method have been compared with the best quality Italian hemp yarns in regard to fineness and flexibility.

(4) With these yarns the said Company was able to obtain thread No. 16 dry, while the yarns of Sarthe were never able to go beyond the maximum of 7.

(5) The plant never produces offensive smells.

(6) The residual water was discharged into a small stream without occasioning any trouble.

Industrial tests have also been carried out in Italy. One was begun at Giuliano Campania, but was unfortunately stopped at the outset through the war. Another at Coccolia (Ravenna) met with the same fate, and for the same reason. Nevertheless it had already been proved that retting, even in stalks, by this method may with advantage replace the system in use in the countryside, as on this method the price per cwt of retted material is 27 *s.* 5 *d.* in place of the minimum selling price of 32 *s.* 8 *d.*

*Flax.* The application of the method to flax is, from a technical point of view, absolutely identical with its application to hemp in the stalk. The operation here again occupied a minimum period of 42 hours. It is at the present time being tried on a large scale by the *Société Française du Rouissage industriel* at Bonnétable, both for its own account and for account of third persons, to the complete satisfaction of manufacturers. It has an absolutely certain future in all those regions where flax growing is falling off day by day owing to the difficulties created by shortage of labour.

*Ramie.* The method as applied to ramie (*Boehmeria nivea* and *Boehmeria tenacissima*) certainly has a great future. Retting takes 48 to 60

hours, and is a perfect success both on the stalks and the strips and the derived product called " China-grass ". The well known difficulties, however, experienced in getting rid of the cork-like film will hardly allow of applying it except to China-grass. Energetic washing is needed after retting. The resulting fibre, however, differs from the ramie fibre obtained by chemical retting. It differs greatly from silk waste, which the last-named resembles; on the other hand it very much resembles the superfine qualities of flax.

The product obtained is stronger, the fibres are more parallel, and it is easier to obtain long yarns with high yield. It is also possible to carry out bleaching, at least in medium sizes, on the finished yarn, and even to disregard this operation in inferior products and all those which do not need it owing to their purpose. The cost of retting may be estimated at 1 *s.* 8 *d.* per cwt of China-grass in normal times, and the combing yield may go up to 44 %. This method will render ramie-growing possible everywhere, when advances in machinery have furnished the means of producing China-grass by mechanical means. For the moment the industry continues to be completely subservient to the Chinese hand-barked China-grass.

*Agave, other Liliaceae, Jute, etc.* The method is perfectly well applicable to *Agave Americana, Agave sisalana* and *Sanseviera ceylanica.* With regard to the fleshy leaves, they must in the first place be reduced to strips, their tissues roughly crushed, and the product washed after retting. The leaf parenchyma is reduced to a pasty mass easily carried away by water. Drying is very easy, and may be completed in 2 to 3 hours. In 4 days the leaf is reduced to perfect and very white fibre. The retting of jute (*Corchorus* sp.) is also quite successfully accomplished.

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SECOND PART.

# ABSTRACTS

## AGRICULTURAL INTELLIGENCE

### GENERAL INFORMATION.

RURAL HYGIENE

840 – **Recent Researches on the Possible Transmission of Animal Trypanosomiasis to Man: the Biological Reactions in Human and Animal Trypanosomiasis with reference to the Identification of the Virus** (1). — LANFRANCHI ALESSANDRO., in *Atti della Reale Accademia dei Lincei, Serie Quinta, Rendiconti, Classe di Scienze fisiche, matematiche e naturali*, Vol. XXV, part 8, 1st Half Year, pp. 601-605. Rome, April 16, 1916.

The writer wished to find the limits of efficacy of his serum in the presence of the 3 viruses : *Lanfranchii*, *Evansi* and *gambiense*. To attain this object, while keeping the quantity of *virus* invariable (0.2 cc.), he varied the quantity of serum, using it in the proportions of : 1 - 0.5 - 0.25 cc. etc. The duration of contact of the 3 viruses with the writer's serum, with normal serum, and physiological serum was 3 minutes in every case. The different mixtures were then inoculated into the peritoneum of white rats.

It was found that the serum had completely exerted its protective action on the animals inoculated :

with the *virus Lanfranchii* when the serum was used in doses of 1 - 0.5 - 0.25 cc. ; with *virus gambiense*, in doses of 1 cc. ; with *virus Evansi*, in doses of 1 - 0.5 cc.

On the other hand, with *virus gambiense* at the rate of 0.25 cc. it prolonged the course of the experimentally induced disease and with *virus Evansi* in the same amount the prolongation was still greater.

(1) See also *B.* July 1916, No. 767. (*Ed.*)

341 – **Recent Investigations at the Imperial Institute in London, in reference to Maximiliana Fruits, Tobacco, Coffee, Medicinal and Poisonous Plants, and Silk.** — *Bulletin of the Imperial Institute*, Vol. XIV, No. 1, pp. 1-44. London, January-March 1916.

*Cokerite fruits and oil from British Guiana.* — The fruits of the cokerite palm were identified by the Royal Botanic Garden of Kew as belonging to a species of *Maximiliana*, probably *M. regia*. Their structure is similar to that of the fruits of *Elaeis guineensis*, and, like the latter, they furnish 2 distinct oils : that of the pericarp and that of the kernel. An examination of the samples forwarded to the Imperial Institute gave the results set out in Tables I, II and III.

TABLE I. — *Percentage composition of Cokerite fruit by weight.*

| | | | |
|---|---|---|---|
| Bracts | 12.4 | Shell | 53.6 |
| Pericarp | 17.0 | Kernel | 17.0 |

| | |
|---|---|
| Average weight of a fruit | 10.6 gms. |
| Average weight of a nut (fruit without bract or pericarp) | 7.5 gms. |
| Average weight of kernel | 1.3 gms. |

TABLE II. — *Composition of Cokerite oils.*

| | Pericarp oil | Kernel oil (3) |
|---|---|---|
| Specific gravity at $\frac{100°C}{15°C}$ | — | 0.8668 |
| Melting point (in open tube) | — | 27°C |
| Solidifying point of fatty acids | 25.5°C | 24.2°C |
| Acid value (1) | 28.6 | 3.1 |
| Saponification number (1) | 211.6 | 253.0 |
| Iodine number | 51.4 % | 13.0 % |
| Hehner value | — | 88.9 |
| Insoluble fatty acids | — | 88.6 % |
| Non-saponifiable substance | — | 0,3 % |
| Soluble volatile acids (2) | — | 3.0 |
| Insoluble volatile acids (2) | — | 7.0 |

TABLE III. — *Percentage composition of a cokerite kernel cake, calculated for a cake containing 7 % of fatty substance* (4).

| | | |
|---|---|---|
| Water | | 8.6 % |
| Crude protein 15 % | True protein | 14.7 |
| | Other nitrogenous substances | 0.3 |
| Fat | | 7.0 |
| Starch, etc. (by difference) | | 52.5 |
| Cellulose | | 12.6 |
| Ash | | 4.3 |
| | | 100.0 |
| Nutritive ratio | | 1 : 4.6 |
| Nutritive units | | 108 |

(1) Number of mg. of potash for 1 gram of oil.
(2) Number of cc. of decinormal alkali needed to neutralise acidity in 5 gr. of oil.
(3) Prepared at the Imperial Institute.
(4) The kernels contained 11.3 % of moisture and yielded 56.9 % of fat.

From a comparison with the oils and cakes of *Elaeis guineensis* an *Cocos nucifera* it is found that those of cokerite are almost equal in valu The problem in the utilisation of this fruit is to design a machine by whic the nuts can be crushed.

*Nyassaland Tobacco.* — Of late years, tobacco has become the chi export article of Nyassaland. In 1914-1915, 3 308 948 lbs. were exporte of a value of £ 82 735 (on the spot). This figure is slightly below that the previous year. In 1915-16, tobacco growing covered 9042 acres. A most the whole of the exports go to the United Kingdom. The averag unit production was rather low in the last period of 6 years ; if ranged b tween 305 lbs. per acre in 1912-1913 and 520 lbs per acre in 1910-1911. Th district of Blantyre furnishes nearly $^2/_3$ of the production. The varieti most grown are : " Gold Leaf ", " Warne ", " Conqueror " and " Whit Stem Orinoco ". From experiments carried out in the last 2 years by th Nyassaland Department of Agriculture, it results that " Gold Leaf " is pe haps the best adapted variety for the greater part of the Nyassaland tract where tobacco is grown. It is of good cropping power and seems to poss the largest proportion of light coloured leaves. Twelve varieties of tobac were cultivated in 1914-1915 at the Government of Nyassaland Exper mental Station. The crop samples sent to the Imperial Institute contained from 12.5 to 14.7 % of moisture, from 1.8 to 3 % of nicotine, from 1.8 t 2.9 % of nitrogen, from 11.0 to 12.8 % and in one case, 18.2 % of ash. The were valued (October 1915) at from 4 d. to 7d. per lb. The ash always co tained a good deal of potash, a few sulphates and a few chlorides. The burn ing qualities of the tobacco are excellent.

*Uganda Coffee.* — Coffee cultivation is making rapid strides in Uganda It is the chief crop of farms under European management, on which *Coffe arabica* occupies 9551 acres and *Coffea robusta* 367 acres. Coffee is inte planted with *Hevea brasiliensis*, which covers 4835 acres (the greater portio of this area is planted with trees under 2 years old); it is also cultivated a the different Missions, over an area of about 660 acres, and by the natives o an area of 8692 acres (estimated). These figures relate to 1914-1915, in whic years 18998 cwt of coffee in the parchment (unhusked) of a value of £ 35 46 were exported. Two samples sent to the Imperial Institute for exam ination were estimated after husking at 54 *s.* to 55*s.* per cwt. in Londo (December 1915).

*Drugs supplied by African Solanaceae.* — The percentage hyoscyamine (with which it is easy to prepare isomerous atropin now rare on the market), was determined at the Imperial Institute in sp cimens of *Hyoscyamus muticus* coming from the Soudan, and *Datura Str monium* from Egypt, the Soudan and South Africa. The results were a shown in Table IV.

While the seeds of *D. Stramonium* from the Soudan are of no industri value for the extraction of hyoscyamine, the leaves of the same species com ing from South Africa are well adapted for this purpose. In all cases, th total alkaloids were constituted almost exclusively by easily crystallisabl hyoscyamine.

TABLE IV. — *Total percentage of alkaloid in the samples of Hyoscyamus and Datura (percentage of dried substance).*

| | |
|---|---|
| *Hyoscyamus muticus*: leaves and stalks | 0.770 % |
| *Datura Stramonium* from Egypt: stalks and fruits | 0.138 |
| " " " " leaves | 0.320 |
| *D. Stramonium* from the Soudan: stalks, and fruit cases | 0.130 |
| " " " " " seeds | 0.096 |
| *D. Stramonium* from South Africa: leaves | 0.540 |

*Medicinal and poisonous plants from South Africa* (1). — A summary of the results hitherto obtained at the Imperial Institute from a study of the following species: — *Senecio latifolius*, producing the " Molterno disease " in livestock; — *Acokanthera venenata; Ornithoglossum glaucum* (« Cape Slangkop ») a poisonous pasturage plant; — *Homeria pallida*, causing great losses of livestock yearly in the Transvaal; — *Crotalaria Burkeana*, causing the disease known as " stiff sickness " in livestock; — *Chailletia cymosa* (= *Dichapetalum cymosum*), known in S. Africa as " Gift-blad ", one of the South African plants most injurious to cattle; — *Strychnos Henningsii*: in Eastern Pondoland, by infusing the bark of this plant in alcohol, bitters are prepared which are used as an aperient; the bark and the fruits contain a still unidentified alkaloid; — *Gonioma Kamassi* which contains alkaloid in its bark; *Mesembryanthemun Mahoni* — the roots of which contain a large proportion of oxalates, a yeast (Torula), and the moulds *Mucor erectus*, *Aspergillus oryzae*, as well as *Rhopalocystis nigra* (= *Aspergillus niger*), are used in the preparation of an intoxicating and poisonous liquor by the natives of the Transvaal and as yeast for bread by the whites; — *Raphionacme divaricata*: its roots yield by fermentation an intoxicating and poisonous liquor employed by the natives; — *Datura Stramonium*; — *Barosma venusta* — *Kaempferia Ethelae*, the dried tubers of which are used in the popular medicine of the Rand natives; — *Bersana Tysoniana* — the bitter bark of which is used as a drug by the natives; — *Chrysophyllum viridifolium* and similar species: from their bark a substance resembling saponin is extracted; — *Urginea Burkei* — which causes heavy losses of livestock in South Africa; — *Buxus Macowani*: its wood, known as " South African boxwood " or " Cape boxwood " is adapted for turning and wood carving work like that of *B. sempervirens*, when certain precautions are taken in cutting and drying it. It abounds in the forests of Alexandria, Cape Province, and still more in those of Transkeian.

*Trinidad Silk.* — A first attempt at silkworm breeding was made in Trinidad in 1868, in which year *Attacus ricini* was introduced and successfully reared in that island. In 1893 there werre imported: *Antheraca pernyi; Attacus cynthia; Telea polyphemus; Callosamia promethea.* The first named was successfully reared on leaves of *Terminalia Catappa;* the second on leaves of the castor oil plant; the cocoons obtained were smaller than those imported; the other two were not successful. Further trials prove that *Attacus cynthia* can be acclimatised in Trinidad. *Bombyx mori* was imported there in 1907. Up to now its rearing has been ra-

(1) See also *B.* March 1915, N° 246. (*Ed.*)

ther limited ; it has not been attacked by any disease ; two breeds are rea ed, one with yellow, the other with white silk. Crosses between these tw have also been made. In Trinidad there is a wild silkworm, *Attacus hespe us*, which feeds on the leaves of *Casearia* sp. ; it can be reared artificiall but the moths must be enclosed in cages for mating and oviposition.

Specimens of cocoons of *Bombyx mori* (yellow and white), *Attacus r cini* and *Attacus hesperus* examined at the Imperial Institute were found t be of good quality.

There is no doubt that silkworm rearing can be successfully establishe in Trinidad. Of the different species there tested, those yielding the be results are *Bombyx mori*, and especially *Attacus ricini*, which stands high temperatures and furnishes more easily handled cocoons.

## CROPS AND CULTIVATION.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

842 - **On the Origin of "Red Soil".** — MANASSE E., in *Giornale di Geologia Pratica*. XIII Year, Part III-IV, pp. 101-103. Parma and Pisa, 1915 (1).

Trial analyses were made of two red soils from the " Montagnola of Sienna, namely, a complete analysis, treatment with hydrochloric ac in the presence of kaolin, attack by sulphuric acid, solubility in hot dilu potassium hydroxide. From these experiments it would appear that 1) the alumina to a fairly large extent, almost the whole of the ferric oxid a smaller proportion of the silica, and the slight amount of sesquioxide manganese present, are in the form of colloidal hydroxides in the two re soils ; 2) the rest of the alumina is mostly in the state of clay (kaolin but also to a lesser extent in the form of silicates of aluminium, potassiu and sodium with and without iron and magnesium (micaceous minerals ? 3) the excess of silica must be attributed to quartz ; 4) while the lim in the two red soils is due almost exclusively to calcium carbonate, th magnesia is only attributable in part to the carbonate of magnesium, the re belonging to silicates which are little soluble or insoluble in hydrochloric aci

In conclusion, the two red soils examined did not consist exclusive of a clayey ochreous-quartzite matter as they also contained hydroxi of iron in the colloidal state, accompanied by gelohydrates of aluminiu and in smaller quantities, by silica and manganese. The two Sienna re earths present a great analogy in this respect with those of Croatia, whic are considered similar to bauxites from the physical, mineralogical, an genetic point of view.

With regard to the genesis of the red earths in question, the Auth is inclined to consider them as deposits of colloidal solutions mixed wit matters originating from the alteration and weathering of anagenetic, schist phylladic, quartzose, etc. rocks which in the " Montagnola " of Sienna a company cavernous limestone, not excluding however the action of fe ruginous thermal waters slightly impregnated with manganese and charge with carbonic acid gas.

(1) See Vinassa de Regny P., " Red Soil ", *Bulletin* September 1915, pp. 1134-1138. (*Ed.*)

843 – **Researches in Agricultural Bacteriology carried out in Denmark during the Period 1904-1914.** — CHRISTENSEN H. R. (Director of the State Agricultural Laboratory). — *Communication made to the International Institute of Agriculture by its Correspondent for Denmark, Baron de Rosenkrantz.*

These investigations were carried out during the period 1905-1909, in the laboratory of agricultural bacteriology of the Royal Higher School of Veterinary Medicine and Agriculture under Prof. Weiss and, from 1909, in the State Agricultural Laboratory, the direction of which was taken over by the same gentleman.

I. — *Two fluorescent denitrifyng Bacteria.* — These two bacteria, isolated by the writer, are distinguished from all other fluorescent denitrifying bacteria by the fact that they do not liquefy gelatine. One of them, *Bac. denitrificans b*, is capable only of reducing nitrates, while the other, *Bac. denitrificans a*, reduced both nitrites and nitrates (1).

II. — *New Principles of Analysis of Soils in connection with certain data as to the presence and distribution of Azotobacter chroococcum in various types of soils.* — Preliminary considerations as to the progress of soil research in connection with rural economics ; the hygroscopic qualities of soils in Denmark ; the importance of the methods of RODERWALD and MITSCHERLICH for determination of hygroscopicity, growth in area of particles of earth, the state of subdivision of soil ; on the need for studying the reaction and basic quality of the soil, being properties closely bound up with its microbiological condition. After glancing at the principles hitherto adopted in bacteriological analyses, the writer gives notes on the result of his investigations of a nitrogen-fixing bacillus, *Azotobacter chroococcum*. In determining the factors causing its presence in the soil, the method was adopted of comparing an ordinary culture of the soil with other cultures into which large quantities of the microbe had been inoculated whose specific behaviour in different types of soil it was required to study in order to ascertain whether the differences in the tendency to decompose given substances are to be attributed to the microbiological or chemical condition of the soil. It was found that the presence of a growth of *Azotobacter* in a solution of mannite (1 litre of distilled water, 20 grms of mannite and 0.2 grms of bipotassic phosphate) is a reliable indication of the presence of basic compounds of calcium and magnesium in the soil in question, and may also form the criterion for determining the basic quality of the soil. This is perhaps the first example of a specific property of the soil investigated by microbiological methods. An analogous process is represented by the investigations of the presence in the soil of readily soluble phosphoric acid (2).

III. — *New Biological Method for Determination of alkaline Carbonates in the Soil.* — There are soils which, when brought into contact with a solution of mannite freed from lime and inoculated with *Azotobacter*, are un-

(1) *Centralblatt für Bakteriologie, Parasitenkunde und Infectionskrankheiten* II, Vol. XI, pp. 190-194. Jena, 1904.

(2) *Tidsskrift for Landbrugets Planteavl*, Vol. XIII, pp. 145-194. Copenhagen, 1906.

able to promote the growth of an azotobacterial flora. If calcium sulphate is then added to the solution, all the soils do not behave in the same way; in some a regular growth of the *Azotobacter* is observed, and no growth of the others. These differences in behaviour are taken to be due to the percentage of alkaline carbonates, which varies from soil to soil. This furnishes the elements for a new biological method of determining the content of the soil in basic substance (1).

IV. — *Enquiries into the Relation between the Composition of the Soil and the Presence of Plasmodiophora brassicae.* — Applying the microbiological method for determination of the soil reaction, the Writer was able to demonstrate the existence of a fairly close relation between the presence of *Plasmodiophora brassicae* and the alkalinity of the soil. The greater the the reduction in the latter, the greater the likelihood of attack, which is almost impossible in a markedly alkaline medium. I. KÖLPIN RAVN also studied the relation between the behaviour of the soil and the presence of various grass plants, arriving at the conclusion that the terms *calcifugal* and *calciphilous plants* ought to be replaced by the terms *basifugal* and *basiphilous plants*, or *acidifugal* and *acidiphilous*. Acidiphilous species would be : *Rumex acetosella, Raphanus raphanistrum, Viola tricolor, Scleranthus* (?) *annuus, Cynaphalium uliginosum, Spergula arvensis* ; and basiphilous species, *Sinapis arvensis and Veronica agrestis* (2).

V. — *On the Fixation of atmospheric Nitrogen by free Microorganisms.* — A comprehensive study of the most important researches in connection with this question, and the results obtained by the Writer's experiments (3).

VI. — *In connection with the decomposition of Urea.* — A preliminary note to a study of the action of humus compounds on the splitting up of urea into ammonia (4).

VII. — *Investigations in reference to determining the Lime Requirements of the Soil* (5).

VIII. — *Influence of Humus on the Ammonification of Urea.* — The generally adopted opinion that humic substance cannot supply organisms with carbon as a food is incorrect. It results from these investigations that, in reality, many microbes capable of splitting up urea can not only utilise the humic substance, but even prefer it to all the other compounds of carbon experimented with (laevulose, xylose and various organic acids). There are also organisms which possess the property of decomposing urea even in the absence of any other organic substance, utilising it as a nutrient medium

(1) *Tidsskrift for Landbrugets Planteavl*, Vol. XIV, pp. 292-294. Copenhagen, 1907. — *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten* II, Vol. XIX, pp. 735-736. Jena, 1907.

(2) With Kolpin-Ravn F. and Harder P. *Tidsskrift for Landbrugets Planteavl*, Vol. XVI, pp. 430-476. Copenhagen, 1909.

(3) *Tidsskrift for Landbrugets Planteavl*, Vol. XVI, pp. 303-336. Copenhagen 1909.

(4) *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten* II, Vol. XXIV, p. 130. Jena 1909.

(5) With Larsen O. H. ; see *Bulletin* for January 1911, No. 59. (*Ed.*)

such is *Urobacillus Beijerinckii*, isolated and carefully studied by the writer (1).

IX. — *Method of determining the Capacity of the Soil for decomposing Cellulose.* — This new method described by the writer presents the advantage that by adopting a substance made up exclusively of the compounds of nitrogen required for the nutrition of the microbes and containing no utilisable nitrogen or mineral substances (in this case filter paper without ash) the rapidity with which cellulose is decomposed must be related to the quantity of cellulose contained in the soil in a form accessible to microbes (2).

X. — *Further Researches into the Formation of Nitric Acid in Stable Manure and the Soil.* — A critical review of the literature on this question (3).

XI. — *Microbiological Researches into Peat Soils.* — In the first part of this work the Author deals with the characters presented by the flora of uncultivated peat soils ; in the second, with the chemical composition of peat soils, and finally, in the third, with the microbiological state of peat beds brought under cultivation. From this last point of view, he notes a great difference between peat beds formed by sphagnum and infra-aquatic peat beds. The former are distinguished by their feeble tendency to split up peptones, their high denitrifying power, their very weak capacity for decomposing cellulose and mannite. Infra-aquatic peats exhibit a diametrically opposite behaviour, and it is of interest to note that these peats in addition to having a strong acid reaction, contain a considerable number of nitrogen-fixing bacteria. It must consequently be supposed that the existence of these differences between the two formations will facilitate the study of yet unexplored peat beds (4).

XII. — *Determination and Significance of the Reaction and Basic Quality of the Soil.* — A report submitted to the International Congress of Agriculture at Ghent in 1913, and forming an exposition and a critical examination of the methods proposed by the author for determining the basic reactions of the soil, the putting into practice of these methods and their importance in soil research. It is indispensable that landowners should know the reaction and basic quality in order to draw logical conclusions as to cultural methods.

XIII. — *Relation between the Properties of the Soil and the Utilisation of different Phosphates.* — The tricalcic phosphate found in bones and na-

(1) *Tidsskrift for Landbrugets Planteavl*, Vol. XVII, pp. XVII. pp. 79-109. Copenhagen, 1910. — *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten* II, Vol. XXVII, pp. 336-362. Jena, 1910.

(2) *Tiddskrift for Landbrugets Planteavl*, Vol. XVII, pp. 356-359. Copenhagen, 1910. — *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten* II, Vol. XXVII, pp. 449-451. Jena, 1910.

(3) *Tidsskrift for Landbrugets Planteavl.*, Vol. XVIII, pp. 167-176, Copenhagen, 1911.

(4) With Mentz A. and Overgaard O. : *Tidsskrift for Landbrugets Planteavl*, Vol. XIX, pp. 595-652. Copenhagen, 1912. — *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten* II, Vol. 37, pp. 414-431. Jena, 1912.

tural phosphates is difficult to utilise in basic soils; the use of fertilisers of this kind must therefore be carefully avoided in soils shown by microbiological analysis (i. e. with Azotobacter) to be basic. On the contrary, there cannot be any relation between the reaction and basic quality of the soil on the one hand and the utilisation of superphosphates and basic slag on the other, nor yet between the property of assimilating phosphates difficult of solution and the capacity of setting free acids, as for instance acetic acid from calcium acetate (1).

XIV. — *Influence exercised by the Nature of Earths on the Bacteria and Chemical Condition of the Soil* (2).

844 - **Conversion of Soluble Phosphoric Acid into Insoluble Phosphoric Acid in the Soil under the Influence of Physical, Chemical and Biological Factors.** — Skalkij S., in *Южно-русская Сельско-хозяйственная Газета* (Agricultural Gazette of Southern Russia), XVIIth Year, Nos. 33, 34, 36, 37 and 38, pp. 6-7; 6-7; 7-8; 9-11; and 6-8. Kharkov, 1915.

The experiments were carried out at the agricultural experiment Station of Ploty (Podolia), where, for several years running, both by chemical analysis of the soil and experiments conducted in the laboratory and the open field, it was ascertained that among the principal elements of fertility in the soil of the Station, classed as " tchernoziom ", the most deficient was phosphoric acid, that is, in a form which could be readily assimilated by plants (3).

The object of the experiments was to study the intensity of fixation of phosphoric acid soluble in water, added to the soil, under the influence of chemical, physical and biological factors, in various layers of soils under a different cultural condition. By biological factors is meant the action of the micro-organisms of the soil and that of plants. In the experiments undertaken, plants were excluded. Consequently only the fixation of phosphorus by micro-organisms was studied.

The experiments were conducted with 4 different soils: April fallow soil, i. e. that begun to be tilled in April; soil which had been uncultivated for many years; kitchen-garden soil; and finally the soil of an old oak wood. Two layers were studied in each of these lands, the one arable 0 to 17.7 cm. deep, and the other below the first, from 17.7 to 35.5 cm. deep. For each experiment a quantity of earth corresponding to 1 kilogram in absolutely dry condition was taken. The experiments are divided into 2 series: in

(1) *Tidsskrift for Landbrugets Planteavl*, Vol. XX, pp. 90-104. Copenhagen, 1913. — *Fühling's landwirtschaftliche Zeitung*, Year LXII, pp. 392-405. Stuttgart, 1913.

(2) See *B.* June 1915. No. 682. (*Ed.*)

(3) In the publication of the Department of Agriculture « Сельско-хозяйственный промыселъ въ Россіи » (Agricultural Industry in Russia), (1895-1913), Petrograd, 1914, published in Russian and French, it is stated, in connection with the Ploty Station (in the chapter where brief particulars of the scientific work of the principal Russian Agricultural Experiment Stations are given), that " its investigations in connection with the conditions affecting the contents of the soil in two principal elements of fertility, nitrogen and phosphorus, have gained it a wide reputation ". The results of the experiments summed up in this article supplement those which appeared on page 188 of the publication in question.

the first there was added to each sample of earth in addition to water soluble acid potassium phosphate (1.3312 g. of $P_2O_5$), 3.605 g. of potassium nitrate in order to observe how this addition affects the total fixaction (i. e. that due to physical, chemical and biological factors) of soluble phosphoric acid. These experiments were made with the April fallow soil and the soil long out of cultivation. In the second set of experiments part of the soil was treated with chloroform, to suspend bacterial life and consequently the fixation of phosphorus by these bacteria ; the other part of the soil not being so treated. The object was to differentiate the fixation of soluble phosphoric acid produced by physical and chemical factors from the biological fixation due in this case to the activity of the micro-organisms. The quantity of chloroform added was 50 cc. and that of phosphoric acid the same as in the previous case.

To all the samples of air-dried earth 35 per cent by weight of water was added, to stimulate activity of the micro-organisms ; in order to prevent evaporation of water the samples were put into big bottles with ground glass stoppers. During the entire continuance of the experiments (3 months) the temperature ranged between 15° and 25° C. The external appearance of the samples remained normal until the end of the experiments. On completion of the latter, the soluble phosphoric acid, which had remained as such in the soil, was extracted by distilled water, of which 4 litres per sample were added. The duration of treatment with water was 8 hours. Care was taken to shake up the solution every 15 or 20 minutes.

The results of the experiments are summed up in the appended Table.

From the results obtained the writer deduced the following conclusions :

1) The process of fixation of water-soluble phosphoric acid depends both on the chemical and physical factors and on the biological factors of the soil.

2) The intensity of total fixation of the said acid is in direct relation to the cultural conditions of the soil.

3) The intensity of total fixation of the said acid increases with the addition of potassium nitrate to the soil.

4) The process of fixation of water soluble phosphoric acid in the non-chloroformed, i. e. the natural, samples of earth takes place with greater intensity than in the chloroformed samples.

5) The total intensity of fixation and the physical and chemical fixation of water-soluble phosphoric acid is less in the arable layer (from 0 to 17.7 cm. depth) than in that lying immediately beneath (from 17.7 to 35.5 cm).

6) The intensity of the process of assimilation of phosphorus is greater in the arable layer than in that immediately beneath.

For better study of the phenomenon of assimilation of phosphorus the writer also carried out experiments on the bacterial flora of each of the samples of soil capable of multiplying in peptonised meat bouillon, with agar or gelatine, dilute to 0.001 and 0.0001. By calculating the number of bacteria per gram of absolutely dry soil, data were obtained from which it may

*Fixation of Phosphoric Acid soluble in water, in percentages of the quantity added to the soil* (1. 3312 g. of $P_2 O_5$).

| Fixation of water soluble phosporic acid | In the layer from 0 to 17.7 cm. deep. | | | | In the layer from 17.7 to 35.5 cm. deep. | | | |
|---|---|---|---|---|---|---|---|---|
| | April fallow | Uncultivated land | Kitchen garden soil | Forest soil | April fallow | Uncultivated land | Kitchen garden soil | Forest soil |
| A. *1st Series of Experiments.* | | | | | | | | |
| I. Total fixation (supplying potassium nitrate) | 89.89 | 87.93 | — | — | 92.56 | 89.87 | — | — |
| II. Total fixation (without potassium nitrate) | 87.14 | 84.04 | — | — | 91.64 | 86.92 | — | — |
| B. *2nd Series of Experiments.* | | | | | | | | |
| I. Total fixation (in chloroformed soil) | 87.14 | 84.04 | 84.06 | 75.28 | 91.64 | 86.92 | 84.11 | 83.87 |
| II. Physico-chemical fixation (in chloroformed soil) | 84.90 | 81.92 | 82.58 | 73.16 | 89.94 | 86.05 | 83.29 | 83.65 |
| III. Biological fixation due to micro-organisms, or assimilation | 2.24 | 2.12 | 1.48 | 2.12 | 1.70 | 0.87 | 0.82 | 0.22 |

be deduced that the quantity of these bacteria increases with the improvement of the cultural condition of the soil.

As regards the relations between the quality of the bacterial flora of the soil and the intensity of assimilation of phosphorus, it is stated that there is no possibility of ascertaining them by means of the data obtained. There are however some indications pointing to the existence of such relations.

MANURES AND MANURING

845 – **Rapid and simple Determination of the Nitrogen in Liquid Manure by means of a Densimeter.** — VOGEL, in *Illustrierte landwirtschaftliche Zeitung*, 36th year, No. 39, pp. 277-278, 1 fig. Berlin, May 13, 1916.

Many endeavours have been made to devise a good method by which farmers might themselves rapidly and accurately ascertain the value of liquid manure, but hitherto without much success. Thus, VON AHR observed certain relations between the specific gravity on the one hand and the proportions of dry substance and nitrogen on the other by means of which a fairly accurate and practical method might be contrived; VON FEILITZEN has also published some notes which suggested a certain relation between the specific gravity and the content of nitrogen.

The recent experiments of the writer have shown that there is only a reliable relation between the specific gravity and nitrogen where the liquid manure is fermented to a sufficient degree. The more the composition resembles that of fresh urine, the less evident the relation becomes. In order to be able to establish the relation clearly, 80 per cent of the total

nitrogen must be in the form of ammonia. The urine at the time of analysis must therefore not be too fresh ; it must have been in the pit for at least 10 to 14 days. It was also found that fairly wide variations of the nitrogen content are accompanied by only slight variations in the specific gravity, and that the relation differs according to whether the urine is from cattle only or a mixture from different livestock. In cattle, urine relations are more regular.

On the strength of these observations the writer designed a densimeter which enables the nitrogen content of the urine to be rapidly ascertained with fair accuracy. His observations referred only to pure cattle urine. The densimeter very much resembles that for measuring the density of milk ; as in the latter case, it is immersed in the liquid in question and the number of degrees read off on the scale ; the temperature of the urine should be from 16 to 17° C. The greater the number of degrees shown, the smaller the content of nitrogen and vice-versa.

The percentage of nitrogen was ascertained in the urine of a number of different animals by means of the densimeter and the chemical method ; it was found that the result is almost the same by the two methods. The relations ascertained by means of the densimeter are as follows :

| Specific gravity of urine | Quantity of nitrogen found in 1 litre of urine |
|---|---|
| Up to 1.01 | Up to 2 gms. |
| 1.01-1.017 | 2-3 |
| 1.017-1.020 | 3-4 |
| 1.020-1.027 | 4-5 |
| 1.027-1.032 | 5-6 |
| 1.032-1.038 | 6-7 |
| More than 1.038 | More than 7 |

The densimeter consequently furnishes a means of examining the majority of the cattle urines used in practice. On the basis of these data it is possible to calculate the quantity of liquid manure to be used when grass-land is to be manured with a given quantity of nitrogen. For instance, if the densimeter shows the proportion of nitrogen of 4 to 5 gms per litre and the grass-land is to be manured with 30 kg of nitrogen per hectare (26.8 lbs per acre), from 6000 to 7500 litres (534-668 gallons per acre) of urine must be used.

The addition of a small quantity of water to the urine does not very much affect the result, but a large quantity is injurious.

The densimeter is made by the firm of HUGERSHOFF in Leipzig.

846 – **Experiments on Humogen or Bacterised Peat** (The Woburn Experimental Station of the Royal Agricultural Society of England, Pot Culture Experiments, 1915, IV). — VOELCKER J.A., in *The Journal of the Royal Agricultural Society of England*, Vol. LXXVI, pp. 357-363 + plates 9-10. London, 1915.

The humogen or bacterised peat of PROF. W. B. BOTTOMLEY was compared with nitrate of soda and with controls : 1) in pots containing respect-

ively oats, peas and mustard ; 2) in the open field planted with oats. The humogen used was of the chemical composition shown in the following Table.

*Chemical composition of the humogen.*

| | Dry sample | Wet sample |
|---|---|---|
| Water | 51.49 % | 74.42 % |
| Organic substances | 25.66 | 22.30 |
| Mineral substances | 22.85 | 3.28 |
| | 100.00 | 100.00 |
| Total nitrogen | 1.49 % | 1.38 % |
| Nitrogen soluble in water | 0.08 | 0.48 |

In the pot experiments, in accordance with the instructions of PROF. BOTTOMLEY, bacterised peat was used at the rate of 1 part to 9 or 19 parts of soil, i. e. 89.4 or 44.7 tons per hectare, and the equivalent of nitrate of soda used for moist humogene was in the proportion of 20.9 or 10.4 cwt. per acre.

The results of the pot experiments demonstrate that under the conditions existing when plants are grown under glass are regularly watered and looked after, a good dressing with humogen may produce a considerable development of the green parts, and consequently promote the growth of green forage plants, but it has no advantageous effect on seed production. Under the natural conditions of growth in the open field it was not possible in ordinary crops to detect any advantage resulting from the use of humogen in quantities suitable for the practical farmer, or at the rate of 5 cwt. per acre (1).

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS.

847 - **Growth of the Root System of *Medicago sativa*.** — SHISTOVSKIJ, in *Южно-Русская Сельско-Хозяйственная Газета* (The Agricultural Gazette of Southern Russia), Year XVII, No. 30, pp. 6-7. Kharkov, August 1915.

The following experiments were carried out by the Plant-Breeding Section of the Regional Agricultural Experiment Station of Kharkov, the object being to study of the growth of the root system of *Medicago sativa* in its different phases of vegetation.

Lucerne from a farm in the province of Ekaterinoslav was sown in 12 Rotmistrov boxes placed in the ground without any cover and filled with soil from a lucerne field of the Station. Sowing was carried out on the 21st April, with ungerminated seeds, at the rate of 10-20 to each box. On the 2-3 May, all the plants except one were removed from each vessel. For some time, namely until the plants had grown robust, they were watered every day ; they were then allowed to grow under natural conditions, with only occasional watering, once or twice a week.

The roots were separated by washing with water six times, namely when the plant had reached the age of 1, 2, 2 ½, 3, 3 ½ and 4 months ; for

(1) See this *Bulletin*, May 1916, No. 497. (*Ed.*)

each of these operations 2 plants were used, one as control. The results of the experiment are contained in the following table :

*Growth of the aerial and subterraneous portion of Lucerne.*

| Age of the plant in months | Vegetative phase of the plant | Aerial portion | | | Roots | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | General habit of the plant | Length in cm. | | Length in cm. | | Horizontal extension in cm. | | Root coefficient (1) | |
| | | | basal | control | basal | control | basal | control | basal | control |
| 1 | — | 1 stalk | 8 | 6 | 17 | 16 | — | — | — | — |
| 2 | — | 1 stalk | 12 | 10 | 44 | 35 | — | — | — | — |
| 2.5 | — | 1 stalk | 17 | 28 | 51 | 45 | — | — | — | — |
| 3 | flowering | tuft | 37 | 40 | 103 | 110 | 75 | 73 | 7 725 | 8 030 |
| 3.5 | early maturity | tuft | — | — | 104 | 107 | 75 | 89 | 7 815 | 9 523 |
| 4 | completely mature | tuft | 40 | 42 | 108 | 115 | 102 | 91 | 11 664 | 10 465 |

(1) The root coefficient is the product of the length of the root by its horizontal extension.

On analysing the data contained in the table it is seen that the growth of the root system of lucerne continues uninterruptedly from germination to fructification. Nevertheless, it is not uniform. Up to the the age of 2 ½ months, growth takes place with a certain uniformity ; at the end of the first month the maximum length of the roots was from 17 to 16 cm. ; at the end of the second month 44 and 35 cm. and at the age of 2 ½ months, 51 and 45 cm. ; in the two following weeks, which form the pre-flowering period and actual flowering period itself, the growth of the root system was very intense, giving as the result at the end of the third month a length of root from 103 to 110 cm. So great a fluctuation in the growth in length of the root system was not observed either before or after this period. The writer regards this fact as essential in his investigations.

It is interesting to note that the results of the experiments carried out by the writer agree with those obtained earlier with the same plant, *i. e.* lucerne, by V. G. Rotmistrov, but better specify the process of growth of the root system of this plant, by establishing the period of the most intense growth in length. This it was not possible to ascertain from the experiments of Rotmistrov, because he only separated the roots by washing 4 times, namely, 14 and 21 days after germination, and at the beginning of flowering and ripening.

848 – **The Taxonomic Value and Structure of the Peach Leaf Glands.** — GREGORY C. T., in *Cornell University Agricultural Experiment Station of the New York State College of Agriculture*, Bulletin 365, pp. 183-222 + 9 plates. Ithaca, N. Y., November 1915.

Since the early part of the nineteenth century, the leaf glands have been used by all systematists in the classification of peaches and nectarines. Recently some doubt has arisen as to the advisability of using them for classificatory purposes because of their variability.

In a large number of cases the glands are stable and can be safely used to aid in the identification of certain varieties, There are also varieties in which the glands are exceptionally unstable, being on the border line between the two types — reniform and globose — and having what might be termed mixed glands. These mixed glands are of two kinds : one in which the majority of the glands are reniform, intermingled with globose forms ; the other in which the globose form predominates. It would be quite possible, as CARRIÈRE (1867) suggests, to distinguish a third type of gland — the mixed type. It is important that leaves should be chosen from healthy branches on bearing trees. It is also best to obtain a large number of leaves or to examine the tree carefully before making the final selection of leaves. Mature leaves are best because their glands are full-sized and correctly shaped, while on young leaves the form of the glands is usually vague ; old, partly decayed, globose glands frequently have much the appearance of reniform glands.

The structure of the glands shows that they are true glands, having an upper layer of long, rectangular, secretory cells that produce a sweet substance, the function of which is not apparent. After the glands have ceased secreting they begin to decay, becoming brown on the upper surface and slowly disappearing until almost nothing is left. This decaying is a very complicated process, being preceded in every case by a suberization and thickening of the cell walls. The spines of the leaf are very similar to the glands in structure, having the same upper layer of long cells, but with much more heavily cutinised walls. A study of the transitional forms indicates that the glands are merely modified leaf spines.

The leaves with reniform glands are apparently the highest type and the glandless leaves the lowest, with the transition through the globose type.

The serrations of the glandless leaves are very strikingly different from those on a leaf with glands. The former leaves are deeply and doubly serrate, while the margins of the latter are always single and crenate. Almost invariably, when glands develop on a normally glandless leaf, the serrations are transformed to crenations, indicating that there is a very close correlation between the glands and the crenations on the edges of the leaves.

In the appendix a list of 29 works on the subject is given.

849 – **The Root Nodules of *Ceanothus americana* and of *Cycadaceae*.** — I. BOTTOMLEY W. B., *The Root Nodules of Ceanothus americanus*, in *Annals of Botany*, Vol. XXIX, N° 116, pp. 605-610 + pl. XXVIII. London, 1915. — II. SPRATT E. R., *The Root Nodules of Cycadaceae. Ibid.*, pp. 619-625 + pl. XXIX.

I. The writer examined root-nodules from species of *Ceanothus* growing wild in North America, where the genus is indigenous. Nodule-bearing roots of two different species were examined : *Ceanothus americanus* L. (New Jersey tea) and *Ceanothus velutinus* Dougl. (mountain balm). As the preliminary examination showed that the nodules of both species are practically identical, the following description of *C. americanus* applies equally to C. *velutinus*.

The root-nodules of *Ceanothus americanus* are modified lateral roots. They are perennial and increase in size each year by the formation of endogenous outgrowths (branches) similar in structure to the primary branch.

Each primary nodule and branch when fully grown shows four zones : *a*) an apical meristematic zone ; *b*) an infection zone, where the cortical cells are becoming infected with bacteria ; *c*) a bacterial zone, containing many radially-elongated enlarged cells filled with Bacteria ; *d*) a basal zone almost free from bacterial cells.

The younger bacterial cells contain rod-shaped organisms, the older ones spherical bodies. These latter are the " bacteroid " condition of the active nitrogen-fixing rod-shaped bacillus.

The bacteria, when isolated and grown in pure culture, can fix free atmospheric nitrogen, and from their structure, mode of growth and formation of " bacteroids " evidently belong to the *Bacillus radicicola* group.

The paper is accompanied by a bibliography containing 7 references.

II. — Amongst non-leguminous plants it is now recognized that the *Elaeagnaceae, Myricaceae, Podocarpinae,* and the genus *Alnus* have root-nodules, which are definitely concerned with nitrogen assimilation. With these the *Cycadaceae* must be associated, because BOTTOMLEY has isolated from the nodules of *Cycas* not only *Bacillus radicicola* but also *Azotobacter*, both of which organisms are known to assimilate atmospheric nitrogen. They are, however, of special interest because in their cortex a very definite green ring, the algal zone, is produced by the presence of an *Anabaena*, which has been described by the writer.

The first part of the present series of investigations was carried out using as material *Cycas circinalis* L. and *Encephalartos Hildebrantii* A. Br. & Bouché and was extended to comprise the genera *Stangeria, Macrozamia, Zamia, Ceratozamia, Dioon,* and *Bowenia.*

Root-nodules have been found to occur throughout all the genera of Cycads, and as in other non-leguminous plants, they are perennial modified lateral roots which have diverged from their normal growth owing to infection with the nitrogen-fixing organism *Bacillus radicicola.* A whorl of lenticels or a continuous zone of loosely arranged parenchymatous cells is produced at the base of each nodule. The outer cells always become pushed apart and infected by *Azotobacter* and, if suitable conditions prevail, by *Anabaena* also. The presence of the alga stimulates the phellogen to produce

other lenticels, from which and the basal area, a zone of tissue is produced which encloses the original outer cells in which are the algae and bacteria. The algal zone is continuous, except immediately below the lenticels, extending from the base nearly to the meristematic apex.

The algal zone consists of a large air-space containing *Anabaena* and *Azotobacter* which is kept intact by papillate cells traversing it from both the inner and other tissues. *Bacillus radicicola* is chemiotactically attracted to the algal zone, thus leaving the cortical cells in which large quantities of starch grains and sphaeraphides are deposited, and in *Dioon*, also tannin. No algal zone has been observed in *Macrozamia*, *Zamia*, *Ceratozamia*, and *Bowenia*, but nodules are produced by *Bacillus radicicola* and *Azotobacter*.

The Cycadaceae, a group with many primitive characters, are the only nodule-bearing plants known, in which four organisms are associated together symbiotically, *viz.* two nitrogen-fixing bacteria, an alga, and the cycad.

A bibliography containing 11 references is appended.

850 – **The Enzymes Zymase and Carboxylase in the Storage Organs of the Potato and Sugar Beet.** — BODNÁR J. (Chemical Laboratory of the Royal Hungarian Station of Plant Physiology and Pathology, Budapest), in *Mathematikai és Természettudományi Értesitö* (Bulletin of Mathematics and the Natural Sciences), Vol. XXXIII, Parts 3 and 4, pp. 591-610. Budapest, 1915.

After reviewing the work of BUCHNER, STOKLASA, NEUBERG, MAZÉ, PALLADIN and KOSTYSTCHEW, etc. the writer sets out his experiments in detail (summarised in several tables) as carried out on the tubers of several varieties of stored potatoes and on specimens of thoroughly ripe sugar beet.

*Conclusions:* 1) Zymase can be isolated from the storage organs of the potato and the sugar beet. These results agree with the observations of J. STOKLASA.

2) Even though in some cases there were bacteria in the fermenting liquid obtained, they did not exhibit the property of splitting up glucose in the presence of 2 per cent toluol, in the manner characteristic of alcoholic fermentation.

3) The enzyme extracted from the tuber suffering from the disease termed by APPEL " Bakterien-Ringkrankheit " (1) acts on the solution of glucose in such a way that in the fermenting liquid only traces of alcohol can be detected. On the other hand, there is found the presence of an excess of acetic acid due to the action of the soil bacteria (producing alcohol-oxidase) on the alcohol formed by the activity of the zymase. The bacteria of the soil had entered in the spore form into the enzyme extracted from the diseased tubers.

4) Under the action of the enzyme isolated from sugar beet suffering with bacillary gummosis, carbonic acid and alcohol were produced in

(1) Cf : O. Appel, Die Bakterien-Ringkrankheit der Kartoffel, in *Flugblatt* 36 der *Deutschen Kaiserlichen Biologischen Anstalt Dahlem*, 1906. — P. Sorauer, *Handbuch der Pflanzenkrankheiten*, 3rd edition, Vol. I, pp. 398-399. Berlin, Paul Parey, ed., 1909.

much smaller proportions than in the alcoholic ferment. This phenomenon still remains unexplained.

5) Just as in the zymase of yeasts, the presence of NEUBERG'S carboxylase is also recorded in the zymase of potato and sugar beet.

6) The fact that a product acting exclusively on pyrotartaric acid was obtained, but leaving the sugar solution intact, a property peculiar to carboxylase, shows that the latter may also be extracted from the zymase of the potato and sugar beet.

7) In the same way as the carboxylase of yeasts, the carboxylase of the potato and sugar beet is much less sensitive to a high temperature and to different antiseptics than the other zymases.

851 – **Investigations into the Part played by the Amylase in Potato Tubers.** — I. BODNÁR J. (Royal Station of Plant Physiology and Pathology, Budapest), Relation between the amylase and sugar content in stored potato tubers, in *Kiserletögyi Közlemények* (Bulletin of the Agricultural Stations of Hungary), Vol. XVIII, Part 4, pp. 789-795. Budapest, 1915. — II. DOBY G. and BODNÁR J., Amylase in healthy potatoes and in those suffering from leaf curl, *Ibid.* Vol. XVIII, Part 5-6, pp. 956-968, 4 tables, 1915.

I. — According to the enquiries of W. HENNEBERG, the content of sugar in the potato influences its keeping powers, those kinds which are poor in sugar exhibiting greater resistance to bacterial decomposition than those with a relatively large sugar content. A high sugar content thus seems to constitute a predisposition to rot, and it is of great importance from the practical point of view to know this content.

The object of the present work was to examine the possibility of finding a relation between the sugar content of stored potato tubers in the resting state and one of its regulating agents (enzymes) ; in other words to determine, from the proportion of the corresponding enzyme, the total quantity of sugar forming in the tubers in the resting state, and concluding from this whether or not the tubers are adapted for storing. In the total quantity of sugar in the tubers, there was also included the sugar consumed by the respiratory process, because from the point of view of storage, it is important to ascertain the loss of starch occasioned by the respiration of the tubers.

The experiments carried out were for the purpose of determining whether the proportion of sugar in the tuber in a state of rest can be brought into relationship with the activity of the amylase present. The result of the following determinations are given : proportion of amylase in 9 tubers, proportion of reducing sugar (glucose), proportion of non-reducing sugar (saccharose), and total sugar content of these tubers. The experiments, which are summarised in several tables, gave the following results.

Maltase was present in the tubers in a state of rest.

There is no regular relation between the proportion of reducing sugar (glucose) in the tuber and the activity of the amylase present ; the quantity of reducing sugar does not always increase in proportion with the activity of the amylase.

On the contrary, a certain relation can be found between the activity of the amylase and the proportion of non-reducing sugar (saccharose),

as also between this activity and the total quantity of sugar. Thus, with the increase of activity of amylase, the proportion of total sugar and of non-reducing sugar also increases, except in the cases where certain tubers, owing to their more intense respiration, contain less sugar than tubers with amylase of equal activity but weaker respiration.

The knowledge of the activity of the amylase is of great importance from the point of view of storage of the potatoes, inasmuch as those potatoes which contain amylases of higher activity are rich in sugar or their respiration is more intense. It is known, however, from the investigations of W. HENNEBERG, that the tubers with a high sugar content are more liable to rot, and that on the other hand tubers with more intense respiration undergo a larger reduction of the starch content.

Among the tubers subjected to low temperature, increase in the sugar content occurs in those in which the amylases possess greater activity.

II. — The results by means of which DOBY determined the characteristic properties of amylase in potatoes in the resting state afforded the possibility of continuing enquiries into this question. The experiments were carried out on carefully chosen potatoes from the test fields of the Royal Hungarian Station of Plant Physiology and Pathology. A parallel analysis was made of 11 specimens of healthy and diseased potatoes and 9 specimens of exclusively diseased potatoes, along 2 lines : it was ascertained in what way the proportion of amylase is modified first of all in the potato in a state of rest and afterwards in the expressed juice of the tubers and during its storage.

From these researches, it is concluded that a portion of the amylase is present in the potato in the form of zymogene which is transformed into an active enzyme towards the end of the resting stage ; this transformation, however, takes place much more rapidly if the juice of the tubers is kept in the presence of an antiseptic. FORD and GUTRIE, and also VAN LAER, have endeavoured to determine the agents which produce this metamorphosis. They immersed the dust of germinating barley in papaine, which increased the activity of the amylase. There is reason to believe therefore that in the potato also, the action oft he proteolytic enzymes slowly transforms the zymogene of the amylase into free enzyme during the winter rest; this transformation is more rapid in the expressed juice after the cell walls have been destroyed, from which it follows that the action of the amylase becomes stronger in the juice antiseptically stored. Up to the middle of the period of rest, however, the quantity of zymogene is small ; it only begins to increase at the beginning of January, and from this time onwards increased activity of the stored juice may be observed. It is well known that the amylase of the potato is extremely sensitive. It follows that the greater the initial activity of the potato juice, the less this activity increases during the storage of the juice, that is to say, the more quickly it disappears. While the quantity of enzyme in the juice is small and that of zymogene large, so many new enzymes are formed by autolysis from this latter, that a total increase of them is observable, in spite of the weakening and disappearance of the enzymes already present. On the other hand, towards the spring, the

quantity of zymogene constantly diminishes and that of enzyme increases; consequently the action of the fresh juice will be stronger, but during storage it will no longer increase, and as the intensity of activity depends on the continual formation of enzymes by the zymogenes, the weakening of the action will be evident. These considerations lead to the following conclusions: the nearer spring approaches, the more the action of the freshly expresses juice of the tubers will gain in intensity; on the other hand, the activity of the juice prepared in winter increases but little during storage, but is maintained for a long time; the activity of the juice prepared later increases rapidly, but is of shorter duration: finally the activity of the juice prepared towards the end of spring shows no increase and becomes less and less lasting.

Other investigations have brought out the fact that the proportion of amylase in the potato (in the freshly prepared juice) is dependent neither on the variety nor on the soil, but depends on complex factors the elucidation of which requires further research.

The activity of the amylase is almost entirely independent of the size of the tubers.

Finally it was ascertained that, between the tubers of healthy plants and those from plants suffering from leaf curl, there is no correlation in the absolute value of the amylase content; on the other hand, the ratio enzyme to zymogene differs in healthy and in diseased tubers. In the healthy potato there is comparatively more zymogene, and therefore more of it in reserve, than in the diseased ones; the activity of the juice of the healthy tubers is stronger and more constant than that of the diseased tubers. These investigations therefore confirm the observations according to which the curl of the potato leaf is accompanied, not only by mycological, but also by chemical transformations. These researches likewise refute the thesis of MASSEE, according to which, the quantity of amylase is less in the selected potato and consequently resistance to disease would be weakened by selection; if this were true, the amylase content in the diseased potatoes should also be less. Contrary to this view, however, the observations of the writers agree in their general character with those of DOBY, inferred from the chemical composition of the healthy and diseased tubers, and the ratios of concentration of their oxydases, according to which the proportion of the enzyme hydrolysing starch is not in direct relation to the state of health. These experiments have shown that changes indeed take place but they are of so subtle a nature that only minute analyses could make them clear.

Further studies are required to elucidate such questions as to whether the chemico-pathological changes are brought about by pathogenic plant parasites, and to what extent the optimum of amylase and the activation of the latter by foreign substances differ in healthy and in diseased tubers.

852 – **Amount of Humic Substances in Decomposing Leaves** (Laboratory of Scientific Agriculture of the University of Petrograd). — TRUSOV A. C., in *Сельское Хозяйство и Лѣсоводство* (Agriculture and Sylviculture), Vol. CCL, year LXXVI, pp. 339-361. Petrograd, March 1916.

Continuing his researches into the humification of the elements which constitute the vegetable organism (1), the writer now communicates the results of his experiments into the quantity of humus soluble in water and dilute ammonia, produced in the leaves of maple and birch in decomposition; the influence of the conditions under which decomposition takes place; a comparison between the two methods of determination of humic substances, namely the colorimetric method and the permanganate of potash method; and the composition of the humic substances extracted from the decomposing leaves; finally he also gives the conclusions drawn on the basis of these experiments.

In these investigations, maple and birch leaves were employed. The maples leaves were chosen on account of their richness in tannic substances, which, as is proved by the writer's early work, should play an active part in the formation of humus.

The leaves were taken in September, that is, when already yellow; a number of them were taken from the tree, so as to have a product not far advanced in decomposition, and the rest were gathered from the ground a order to secure the bacterial flora, which, under normal conditions, plays a part in the decomposition of maple leaves. For some days, the leaves gathered were dried at a temperature of 15-17° C., 5 grms by weight were then put into each capsule, and 15 cc. of water added every day for a period of 40 days, in order to keep the conditions of decomposition constantly favourable; after this first period, during the following 60 days, only 10 cc. of water were added, with a view to avoiding excessive moisture, as about one-third of the leaves were already decomposed; on the expiry of 100 days only 5 cc. were added. In spite of the addition of this large quantity of water, it may be assumed, in view of the constant temperature of 37° C. that the decomposition of the leaves takes place under the conditions in which it would occur in the case of incomplete water saturation of the leaves, the saturation really only having been complete for a comparatively short time in these experiments. In addition to distilled water, the leaves were, in order to allow of inoculation by their respective micro-organisms, wetted occasionally with some drops of water in which leaves decomposed on the ground had been steeped, the said leaves having been taken from the same tree as those used for the experiment.

The decomposition of these latter was carried out in an incubator at a constant temperature of 36-37° C., which was selected in order to hasten the process in question.

The determination of the humic substances was made after 4, 8, 12, 16, 25, 40, 66 and 100 days from the start of the experiment. Each time 4 dishes were taken, two for ascertaining the quantity of dry matter and, after-

(1) See *B.* 1915, Nos. 347, 888 and 1123; *B.* January 1916, No. 11. (*Ed.*)

wards, the composition of the organic substance of the leaf, and the other two for determining the quantity of humic substance soluble in water and ammonia. Two ammoniacal solutions were used, one to determine the humic substance insoluble in water, and the other to estimate the total quantity of this substance. The determinations were made by the two methods, namely the colorimetric method and the permanganate of potash method.

The results furnished by each method were compared, and the accuracy of the colorimetric method in particular was shown ; the results of both were to a great degree parallel, but reasons are stated for the preference given to the permanganate method, which enables the work to be done much more rapidly.

The results of the experiments on maple leaves are combined in the folllowing table.

*Quantity of humic substances produced in decomposing maple leaves at a constant temperature of 37° C., when these leaves are incompletely impregnated with water.*

| Number of days after beginning of experiment | Part soluble in water. Per cent. | | Part soluble in ammonia. Per cent. | | Total percentage soluble in ammonia | |
|---|---|---|---|---|---|---|
| | Relatively to amount of decomposed leaf | Relatively to maximum quantity of humic substance produced | Relatively to amount of decomposed leaf | Relatively to maximum quantity of humic substance produced | Relatively to amount of decomposed leaf | Relatively to maximum quantity of humic substance produced |
| 4 | 1.16 | 97.3 | 1.02 | 77.0 | 2.19 | 86.4 |
| 8 | 1.32 | 100.0 | 1.47 | 100.0 | 2.79 | 100.0 |
| 12 | 1.27 | 96.3 | 1.23 | 85.9 | 2.48 | 88.8 |
| 16 | 1.07 | 75.5 | 1.17 | 73.8 | 2.24 | 73.8 |
| 25 | 1.10 | 69.5 | 1.71 | 97.0 | 2.81 | 83.4 |
| 40 | 0.53 | 32.4 | 0.99 | 55.7 | 1.54 | 44.3 |
| 66 | 0.64 | 36.5 | 0.56 | 28.7 | 1.22 | 32.4 |
| 100 | 0.50 | 27.4 | 0.94 | 77.4 | 1.48 | 37.7 |

Similar results were also obtained with birch leaves, with the difference that the ratio between the proportion of humic substance soluble in water and that soluble in ammonia is not the same as for the maple leaves (being 1 : 1 in the latter case, against 1 : 2 or 3 in the case of the birch leaves). It was also ascertained that a more thorough drying of the decomposing leaves entails a reduction in the solubility of the humic matter, and that this is probably the cause of the fluctuations still observed in the table reproduced above.

*Conclusions.* 1. — The content of water-soluble humic substance varies according to the decomposed leaves ; for instance, for autumn leaves of the

maple which have just fallen, after 4 days' decomposition this content is 1.93 per cent and represents about 50 per cent of the total content of humic substance.

2. — In the course of the gradual decomposition of freshly fallen autumn maple leaves, the quantity of water-soluble humic substance increases at first and then falls off, a contrary phenomenon to what one would *a priori* assume, seeing that the source of the humus is not the whole of the vegetable substance, but only some of its particular constituents. It follows from this that it is during the first period of its decomposition that vegetable residue takes the most active part in the formation of the soil humus.

3. — The same phenomenon, namely, initial increase followed by subsequent reduction of humic substance, is also disclosed in the case of ammoniacal solutions of this substance. These facts prove clearly that humic substance is chiefly formed during the first brief period of decomposition of vegetable detritus. Then, evidently, this substance itself is partly decomposed and passes partly into other forms of humic combinations.

4. — The ratio between the quantity of water-soluble humic substance and that soluble in ammonia varies with the different leaves undergoing decomposition and the different periods of the process.

5. — The content of humic substance in decomposing leaves depends on the conditions under which decomposition takes place; it declines when repeated desiccation of the leaves occurs and to any considerable extent.

6. — Although the decomposition of the vegetable residue lasted 100 days, the quantity of humic substance formed in the first 8 days was not increased, and after 156 days its solubility in water had completely disappeared.

853 - **On the Nutrition of Green Plants by means of Organic Substances.** — RAVENNA CIRO, in *Atti della Reale Accademia dei Lincei, Serie Quinta, Rendiconti, Classe di scienze fisiche, matematiche e naturali*, Vol. XXV, No. 9, pp. 649-655, figs. 3. Rome, May 7, 1916.

Work carried out in the Laboratory of Agricultural Chemistry of the Royal University of Bologna.

In order to ascertain whether plants can live in darkness, provided organic matter is present in their culture medium, maize plants were grown in a sterilised nutrient solution to which glucose had been added in solutions of 1, 4, 6 and 10 per cent. One plant without glucose was kept as a control. They were kept for comparison, some in the light, others in darkness. Their growth was observed and they were examined for the presence or absence of starch in their leaves. It was found that even when the plants are under conditions which enable them to absorb glucose through their roots, no formation of starch takes place in darkness. Further, the most suitable degree of concentration for the glucose seemed to be 1 to 2 per cent.

In order to ascertain whether the plants treated with glucose had produced starch in their leaves, even in the absence of carbonic acid, a plant in nutrient solution with glucose and a control plant were placed in an airtight glass vessel containing a dish filled with caustic potash. Some

leaves of the plant were covered with strips of black paper. On the following day the starch reaction was tested on some of the leaves, and it was found that the leaves of the plants cultivated in the sugar solution only showed a starch reaction clearly on their parts not covered with black paper, while on those of the control plants the reaction was negative.

In order to ascertain whether starch was formed at the expense of the glucose by direct synthesis, or indirectly by a photosynthetic process at the expense of the carbonic acid as a result of its complete oxidation, it was desired to ascertain which part of the solar spectrum might possess most influence on the phenomenon. For this purpose, the previous experiment was repeated, but the colourless glass of the vessel was replaced by blue glass. For control of this experiment, a plant cultivated in a solution free from glucose was placed in a glass vessel of a similar colour to the preceding one, but without caustic potash, and carbonic acid introduced. In this plant, as in that of the previous experiment, the starch reaction was negative on some leaves; on others slight traces of colouring were shown.

This suggests that for the formation of starch in plants growing in a sugar solution, the same light rays are essential which are responsible for the chlorophyll function. The reaction obtained with the blue glass was much below that obtained with white light, and was equal to the reaction shown by the control plants kept in the coloured vessel in the presence of carbonic acid.

It was then thought that if, with a plant growing in a sugar solution, the formation of starch takes place in consequence of the complete oxidation of glucose, by removing from the atmosphere not only the carbonic acid but the oxygen as well, the starch would be prevented from forming as the glucose could no longer oxidise. A plant grown in a sugar solution was therefore placed in a hydraulically closed bomb containing a tube full of stick caustic potash and filled with pure nitrogen. The starch reaction was negative. The experiment repeated several times yielded the same result, although the plants still retained their vitality.

In order to check the preceding experiment, the plant was kept in the bomb without the tube of caustic potash, and in an atmosphere deprived of oxygen, containing in addition to the nitrogen little carbonic acid; the starch reaction was always positive.

The results of these experiments therefore show that:

1) Plants cultivated in glucose solution show the presence of starch in their leaves, even in the absence of carbonic acid, but only when in the light;

2) The region of the solar spectrum which is most effective in the formation of starch, under the above conditions, is the same one which is most active in the chlorophyllian function;

3) Plants grown in a sugar solution in an atmosphere free of carbonic acid and oxygen, do not form starch in their leaves even when exposed to light.

The logical conclusion is that the sugar absorbed by the roots is oxidised in the interior of the plant itself by the atmospheric oxygen until carbonic

acid gas is formed, which gives rise in the leaves to the formation of starch as a consequence of the chlorophyllian function.

The glucose absorbed is readily oxidised in the plant. This also agrees with the experiments of MOLLIARD (*Comptes Rendus de l'Académie des Sciences*, 141, 389-1905), who, in plants treated with glucose, found a greater degree of acidity, which is a sign of the incomplete oxidation of the sugar.

The investigations will be continued, chiefly with substances of the aromatic series, which are also presumed to be energetically oxidised by plants.

854 – **The Influence of Boron on Plant Growth**. — I. VOELCKER J. A. [The Woburn Experimental Station of the Royal Agricultural Society of England, Pot-Culture Experiments, 1915, (*b*) The influence of Boron Compounds, on 1) Wheat, 2) Barley], in *The Journal of the Royal Agricultural Society of England*, Vol. LXXVI, pp. 347-351 + pl. 3-4. London, 1915. — II. COOK F. C. (Physiological Chemist, Bureau of Chemistry, U. S. Dept. of Agric.). *Journal of Agricultural Research*, Vol. V, No. 19, pp. 877-890. Washington, D. C., 1916.

I. — Duplicate pot-experiments with boric acid and borax upon wheat and barley; the quantities of the boron compounds used were from 0.0001 to 0.10 per cent. of the element as reckoned on the whole content of each pot.

On considering the results obtained the following conclusions may be drawn :

1. Germination is retarded when anything over 0.003 per cent. of boron is used, and even 0.001 per cent., more especially with borax, seems to delay germination.

2. Anything over 0.001 per cent. of boron, either as boric acid or borax, will prevent plants from developing and forming grain.

3. A toxic influence is shown with 0,0005 per cent. of boron, but with quantities not exceeding 0.00025 per cent. there is a slightly stimulating effect.

4. The effects generally are more marked with borax than with boric acid.

II. — The experiments repoited were made in connection with a cooperative study of borax and calcined colemanite (1) as larvicides for the house fly (2) conducted by the Bureaux of Entomology, Chemistry, and Plant Industry, of the U. S. Department of Agriculture. The object of the present paper was to determine the effect of boron-treated horse manure on plant growth, and to study the absorption of boron and its distribution in the roots, stems and fruit of plants grown on soil fertilized with this manure and on soil fertilized with untreated manure. The plants (wheat, beets, tomatoes, cowpeas, lettuce, soybeans, potatoes, corn, oats, radishes, string beans) were grown in pots in the greenhouses of the Department and on open plots at Arlington Experimental Farm, Va ; Dallas, Tex. ; Orlando, Fla. ; and New Orleans, La. At least four pots for each treatment were employed in the pot tests; the plots at Arlington were $^1/_{20}$ of an acre and the others about $^1/_{60}$ of an acre; the tests with lettuce were carried out on

(1) Hydrous borate of calcium. Cfr. DANA'S *Manual of Mineralogy*, 13th. ed., 1912. (*Ed.*).
(2) See *B.* 1915, Nos. 64 and 117.

benches, each 3 × 5 feet. The percentages of boric acid were calculated on a water and ash-free basis.

The general conclusions may be stated as follows :

1. It apparently made little difference in the quantity of boron absorbed by the plants tested whether boron was added to the soil as borax or as calcined colemanite. The addition of lime with borax had no definite effect in preventing the absorption of boron. Wheat and oats absorbed very little boron, while leguminous and succulent plants absorbed comparatively large amounts.

2. Wheat, beets, cowpeas, and tomatoes grown in pots in the greenhouses contained boron principally in the tops of the plants, and, with the exception of the beets, comparatively little or none in the roots.

3. The fruit of the tomato plants contained only traces of boron, while the fruit of the cowpea contained large quantities. Lettuce grown in the greenhouse absorbed boron in proportion to the amounts present in the soil.

4. Potatoes grown in the open showed, when mature, a small amount of boron in the tops and relatively large amounts in the roots and tubers.

5. The leguminous plants, string beans, soybeans, and cowpeas, which were very sensitive to boron, showed, when grown in plot tests, a more equal distribution of the boron among the roots, tops, and fruit than the other plants tested.

6. Radishes grown in plots contained much larger quantities of boron in the tops than in the roots. Analyses of entire plants of wheat, corn, peas, and oats grown on plots in the South showed absorption of boron in all cases, the peas absorbing the most. All of the control plants contained at least a trace of boron.

7. Samples of soil from some of the control plots showed the presence of acid-soluble boron, while several similar samples of soil from certain boron-treated plots showed no acid-soluble boron. Usually more soluble boron was found in the treated soil than in the control soil.

8. The yield of wheat from a plot heavily treated with borax was 90 per cent. of the manured-control yield and was greater than the yield from the unmanured control. The wheat grains were sound and contained but a trace of boron.

9. The yield of tomatoes in pot tests was unaffected when borax was added in amounts giving 0.0018 per cent. of boron in the soil, but when the amount was increased to 0.0030 per cent., a reduced yield resulted.

10. Numerous factors influence the absorption, distribution and action of boron in plants.

11. Not more than 0.82 pound of borax or 0.75 pound of calcined colemanite should be added to each 10 cubic feet of manure, and when using the boron-treated manure in growing leguminous plants, the manure should be mixed with untreated manure before being applied to the soil. For other plants, boron-treated manure should not be used at a higher rate than 5 tons per acre. Fourteen references are quoted in the bibliography (1).

(1) See *B.* Jan. 1911, No. 38, and *B.* May, 1913, No. 483. (*Ed.*).

855 – **The Influence of Strontium Salts on Wheat** (The Woburn Experimental Station of the Royal Agricultural Society of England, Pot-Culture Experiments, 1915, I. The Hill's Experiments, *a*). — VOELCKER J. A. in *The Journal of the Royal Agricultural Society of England*, Vol. LXXVI, pp. 344-346 + pl. 1-2. London, 1915.

Little being known about the action of strontium on plants, duplicate pot-experiments were made with sulphate, nitrate, hydrate, chloride, and carbonate of strontium ; the salts were applied in quantities supplying the element of strontium in two different amounts, namely, 0.05 per cent and 0.10 per cent, reckoned on the whole of the soil used. The soil was of light and by no means rich character, and twelve seeds of wheat were sown in each pot on November, 1914 ; the crops were cut in August, 1915.

The results are summarised as follows :

1. Strontium in the form of the sulphate, hydrate, and carbonate, is, when given up to 0.10 per cent., practically without effect either on the germination of the seed or the increase of the crop.

2. Strontium useed as strontium nitrate produces an increase of crop, but this cannot be attributed to the presence of strontium.

3. Strontium applied as strontium chloride has a retarding effect on germination, and when used in quantity approaching 0.10 per cent. of strontium, has a distinctly toxic effect.

856 – **Experiments in connection with the Assimilation of Potassium and Sodium Ions by the Sugar Beet.** — STOKLASA JULIUS, in *Biochemische Zeitschrift*, Vol. 73, Nos. 3 and 4, pp. 260-312. Berlin, March 24, 1916.

A discussion of the experiments of other scientists is followed by a description of those of the writer ; the object of the latter was to determine :

*a*) The value of potassium chloride and sodium chloride in the production of substance in the root of the beet ;

*b*) Why calcareous soils promote assimilation of potash by the beet and increase the weight and sugar content of the root ;

*c*) The behaviour of calcium chloride in the presence of potassium chloride and sodium chloride ;

*d*) The influence of sodium and potassium chlorides on the development of the sugar beet in the different periods of growth.

For this purpose sugar beets " Wohantas Zuckerreiche " (Wohanta variety rich in sugar) were planted, one in each pot containing 18 kg of a earth manured with different doses of salts. During these experiments, divided into 5 series, the following facts were observed :

1) potassium chloride and sodium chloride increase both the weight of the root and its content of sugar if used separately in a decinormal solution. The potassium ion produces a greater increase than the sodium ion, so that it is really possible to attribute a specific action to it.

2) A stronger concentration of the sodium chloride ($^2/_{10}$ N.) results in a reduction of weight and sugar content in the root. In this concentration, potassium chloride also fails to promote the growth of the plant. A still stronger concentration of potassium chloride ($^3/_{10}$ N.) reduces the percentage of dry matter in the root, and consequently the total quantity of sugar form-

ed, but the percentage of sugar in the root is not changed to any marked extent.

3) An increase of the dry substance and the sugar content is secured by administering sodium chloride and potassium chloride together. A physiologically balanced salt solution, in which the toxic action of the two salts is mutually neutralised, then forms in the soil. To neutralise the toxic properties of a $^3/_{10}$ N. solution of potassium chloride only a $^2/_{10}$ N. solution of sodium chloride is needed.

4) Calcium carbonate employed in a $^3/_{10}$ N. solution in the presence of corresponding quantities of potassium chloride and sodium chloride not only acts favourably on the growth of the root and its sugar content, but is also able to counteract the toxic effect of abnormal quantities of potassium chloride or sodium chloride administered either separately or together. The maximum production of dry substance and sugar is obtained by using the 3 salts (KCl, NaCl, and $CaCO_3$) together. Calcium carbonate especially promotes the growth of the root.

5) The toxic effect of potassium chloride and sodium chloride is counteracted by calcium chloride, but this phenomenon affects rather the content of sugar than the quantity of dry substance. The maximum sugar production was obtained by using the 3 chlorides together.

6) Sodium chloride and potassium chloride do not promote the growth of plants during the first 2 periods of development (after 27 and 57 days respectively), if used separately ; but if employed together, the production of vegetable matter increases. In the 3rd period of growth (after 76 days), when the beet is at a more advanced age, the effect of potassium chloride far exceeds that of sodium chloride. On using both salts together, the increase of production in the third period is not equal to that in the 1st and 2nd period of growth.

7) The anatomical changes in the plants are highly characteristic, if potassium chloride and sodium chloride are not used together in the 2nd period of vegetation. Potassium chloride produces well developed, firm leaves, fairly fine, not very curly, having a leaf stalk rich in chlorophyll, while sodium chloride results in softer leaves, with a fair amount of curl, and with leaf stalks reddish at the base.

The potassium ion therefore has a great influence on the firm consistency of the leaves and promotes the formation of chlorophyll, thus forming an important factor in the process of assimilation.

The sodium ion appears to influence the growth of the epidermis of the plant and to a less extent the process of assimilation.

It was also determined in what measure the potassium ion and the sodium ion were assimilated by the beet plant. The following were the results obtained :

(*A*) The assimilation was at its maximum when the two chlorides were together in the soil in a $^1/_{10}$ N. solution, and at its minimum when sodium chloride alone was in the soil.

(*B*) In those cases where the soil contained either sodium chloride or potassium chloride or both together, in different concentrations, 4.16 grms

of $K_2O$ were required, on the average, for the production of 100 grms of saccharose.

(*C*) The quantity of sodium ions assimilated is related to the quantity of potassium ions, but, according to the analyses made, this relation varies very much.

PLANT BREEDING

857 – **"Thule", a Variety of Wheat suited to Central Sweden.** — Nilsson-Ehle H., in *Sveriges Utsädeförenings Tidskrift*, XXVth Year, Part I, pp. 5-23. Malmö, 1916.

During the period 1889-1913 wheat growing in Sweden increased almost twofold, thanks chiefly to the selection work carried out at the experimental Station of Svalöf, for the purpose of combining in a single variety, the "high productive character of the best types with the "cold resistance" character of the native Swedish wheat.

The increased productivity of grain however was anything but uniform. From a maximum of 200 per cent in the districts of Hallands, Malmöhus and Kristiastads, and generally throughout Southern Sweden (Scania), a minimum of 20 to 30 per cent is reached in the central provinces (Svealand). What is the season of this? In Scania, during the period 1889-1913, the native wheat was gradually replaced by more productive kinds, while the area sown also increased. On the other hand in Svealand this substitution was only possible within very narrow limits, chiefly owing to the special climatic conditions, which involved very cold winters and long periods of drought in summer. For the wheats to be cultivated in the central provinces, therefore sufficient cold-resisting powers and earliness are required to ensure normal ripening and a good yield of grain. These circumstances render the work of hybridisation and selection very difficult, as it is necessary to exclude some of the types which, though among the best in point of yield, are not sufficiently resistant to low temperatures. On the other hand, the increase of the area under wheat in Svealand, the good quality of the soil and the conditions of the agricultural environment, which are as favourable as possible, fully justify all the investigations and work which have for their object the creation of types better adapted to the climate, and at the same time having a high cropping power.

From 1904 onwards the writer has been working at the following problems; 1) the improvement of local native types by selection; 2) creation of new kinds by crossing with the native form; among these crosses the best results were obtained by hybridising the native with the "Pudel"; and afterwards, by perfecting the resulting products by continuous work of selection a new variety was fixed, *Thule I*, presenting the following scheme of characters:

| | Pudel | Thule | Native |
|---|---|---|---|
| Productivity | + | + | — |
| Resistance to cold | — | (+) | + |
| Resistance to rust | + | (+) | — |
| Rigidity of culm | + | + | — |
| Earliness | — | (+) | + |
| Quality of grain | — | (+) | + |

As will be seen, *Thule* I represents a combination superior as regards characteis to that of each of the parents. In productivity (3943 lbs. per acre) it is nearly equal to the " Pudel " (3930 lbs per acre), but is considerably superior to it in earliness and cold resistance, as was ascertained particularly during the winter of 1912-1913, when the sowings were very much injured by the low temperatures.

*Thule II*, resulting from the same cross and isolated by the writer at Svalöf, is still earlier. It is as early as the native type and is more productive than *Thule I*. These two kinds are distinguished from the native Swedish variety by their high resistance to rust. There is consequently no doubt that the *Thule* wheat is superior to all others hitherto tested in Svealand, where it may be introduced with the certainty of success.

As regards improvement of the native varieties by direct selection, the pure line 0750 (of Latorpshvete) from Svalöf was cultivated for 3 years at Ultuna. It is distinguished by its higher cropping power, and could perhaps furnish good material for crosses.

Although the *Thule* wheat is very resistant to cold, it still remains inferior to the native types ; it must therefore be improved in this direction. With this object from 1913 onwards, a series of hybridisation trials were undertaken of *Thule I* and *Thule II* with the Swedish native wheat ; the preliminary results hitherto obtained fully justify the method adopted and hold out the best prospects.

858 - **Experiments on the Germination Capacity of Beet Seeds in Bohemia.** — I. URBAN J. and VITEK E., Influence of very low temperatures on the germination capacity of beet seeds, in *Zeitschrift für Zuckerindustrie in Böhmen*, 40th year, No. 7, pp 29-300, tables. Prague, April 1916. — II. VITEK E., Investigations on the mode of determining the germinating capacity in beet seed. *Ibid.* No. 8, pp. 363-381, tables. May 1916. AGRICULTURAL SEEDS

I. — *Influence of low temperature on the germination capacity.* In a first experiment, 100 grms of thoroughly ripe dried seeds were divided into 2 groups, one of which was exposed for half an hour to the low temperature produced by liquid air allowed to evaporate spontaneously.

In the 2 groups of seeds, the germination capacity was next ascertained by placing them on blotting paper in a thermostat with a temperature varying from 20 to 30° C.

As early as 3 days later, it was found that the vitality of the seeds subjected previously to a temperature of —180° C. had not diminished. Fifteen days later, 95 per cent of the non-frozen fruits and 96 per cent of the fruits exposed to the liquid air had germinated. It is evident from this experiment that the strongest frosts do not impair the germination capacity of seeds with normal water content.

In a 2nd experiment, the object was to study the behaviour of seeds harvested in wet weather. For this purpose 4 samples of seeds were used containing about 20 per cent of water when harvested. The seeds of each of the samples were divided into 3 groups equal in weight and volume, each containing 100 fruits, and for each sample one of these groups was placed in liquid air ; 3 groups remained in it for 2 hours, and one group from 6 to 72 hours.

From the results summarised in the table it is evident that the seeds had, generally speaking, germinated badly, but that freezing for 72 hours had not affected their germination capacity. This experiment therefore proves that it is needless to protect seeds kept dry against frost, as frost only impairs the germination capacity when the seed contains an abnormal (excessively high) percentage of water. It may also be concluded that by drying the seeds artificially not only is their keeping power increased, but their germination capacity is maintained, especially if the seed was wet at the time when harvested.

II. — *Investigations on the mode of determining the germination capacity.* While the method now employed for determining the purity of beet seeds gives fairly accurate and concordant results, the determination of the germination capacity hitherto has remained rather defective as is shown by the relatively large differences in the results of experiments. It was consequently proposed to study this latter question, endeavouring in particular to ascertain whether, for determining the germination capacity, blotting paper or sand gives the best results. Among the samples studied in 1913 by the seed test Station of the " Landeskulturat " of Bohemia, 26 typical samples were chosen for comparative determination of the germination capacity on blotting paper and on sand, always using 100 fruits of each kind in 3 sets of experiments.

It results that blotting paper is better than sand. In 20 samples on blotting paper (77 per cent. of the cases) the germination capacity was better than on sand ; in 9 samples the number of germinated seeds exceeded that of the samples on sand by 1 to 5 per cent; in 10 samples the percentage was 6 to 10 per cent., and in 1 sample 11 to 13 per cent. The same germination capacity on paper and on sand was observed in 2 samples (8 per cent of the cases), while the germination capacity was only greater on sand than on paper in 4 samples (15 per cent of the cases).

The results speak still more clearly in favour of the paper on considering the number of germs. Among the 26 samples studied, 23 (88 per cent. of the cases) gave a larger number of embryos on blotting paper than on sand and only in 3 samples (12 per cent. of the cases) did the fruits give a larger number of embryos on sand.

Analogous results were obtained in 1914.

It is concluded from these experiments that determination of the germination capacity on paper gives better results than on sand ; it is therefore recommended that test Stations should discontinue the sand method in favour of the blotting paper method.

CEREALS

859 – **The Wheats of the State of Washington, U. S. A.** — SCHAFER E. G. and GAINES E. F. in *State College of Washington, Agricultural Experiment Station, Pullman Washington, Bulletin*, No. 121, 16 pp., 2 fig. Pullman, Wa., February 1915.

In the State of Washington, many kinds of wheat are cultivated, mostly introduced into that region, but partly native, and resulting from the different conditions of environment in the various parts of the State. Mixing the different wheats in the fields or on the markets causes a reduction in price, and it is therefore desirable that the number should be limited and

only the best ones should be cultivated in the different parts of the State. The writers describe some of the most important varieties, namely :

1) *Bluestem*, grown largely in the highest parts as spring wheat, sometimes even as winter wheat ;

2) *Red Russian*, the winter wheat most widely grown in the region of Palouse, ripening late and resistant to weeds ;

3) *Hybrid* 143, produced by Prof. W. J. SPILLMAN at the scientific agricultural Station of the State of Washington by crossing White Track and Little Club ; high cropping power ; may be either spring or autumn sown ;

4) *Jones Winter Fife*, the chief winter wheat in the driest part of the State ;

5) *Turkey Red*, the only bearded winter wheat grown in the State of Washington ; yields a good hard grain ; not much cultivated ;

6) *Winter Bluestem*, winter wheat obtained by crossing Turkey and Bluestem, combining the cold resistant powers of the former with the ear and grain characteristics of the latter ;

7) *Forty Fold* (also called *Gold Coin*), the earliest wheat grown in the Palouse region.

8) *Marquis*, recently introduced from Canada, a very early spring wheat ;

9) *Triplet*, a new composite hybrid, not yet distributed to farmers;

*Analyses of Wheat in the State of Washington.*

| VARIETY | Flour per cent. | Dry gluten per cent. | Nitrogen per cent. | Average quality value |
|---|---|---|---|---|
| | — | — | — | — |
| Hybrid 128 | 78.42 | 16.2 | 2.185 | 114.8 |
| Hybrid 143 | 79.59 | 13.0 | 2.120 | 107.8 |
| Red Russian | 82.96 | 10.0 | 1.785 | 93.0 |
| Hybrid 123 | 77.66 | 13.6 | 1.955 | 103.4 |
| Forty Fold | 82.44 | 13.3 | 2.015 | 106.6 |
| Jones Winter Fife | 80.05 | 9.9 | 1.850 | 93.5 |
| Little Club | 78.32 | 10.0 | 1.830 | 93.4 |
| Hybrid 108 | 76.94 | 9.7 | 1.865 | 92.2 |
| Turkey Red | 78.34 | 14.3 | 2.185 | 111.7 |
| Winter Bluestem | 80.75 | 10.0 | 1.940 | 97.5 |
| Triplet | 75.80 | 11.0 | 1.950 | 98.5 |
| Hybrid 60 | 81.90 | 11.7 | 1.615 | 94.5 |
| Hybrid 150 | 79.32 | 8.2 | 1.725 | 86.2 |
| Bluestem* | 81.97 | 10.0 | 2.065 | 98.6 |
| Marquis* | 73.65 | 14.2 | 2.190 | 105.9 |
| Red Chaff* | 81.20 | 10.2 | 2.040 | 99.0 |
| Little Club* | 79.02 | 11.1 | 2.160 | 102.3 |
| Hybrid 143 | 78.62 | 10.2 | 1.990 | 100.2 |
| Averages | 79.3 | 11.6 | 1.970 | — |

* Grown as spring wheats.

10) *Hybrid* 128, produced in 1899 by PROF. SPILLMAN, from a cross between Jones Winter Fife and Little Club ; high crop yield and good quality ; stiff straw ; does not shatter.

11) *Little Club* ;

12) and 13) *Hybrids* 123 and 108, originating from a cross between Jones Winter Fife and Little Club ;

14) and 15) *Hybrids* 150 and 63, Cross Turkey Red × Little Club ; the latter, highly resistant to drought, is rapidly increasing in popularity as a winter wheat ;

16-19) *Red Allen, White Elliot, Sonora and Jenkins Club*, spring wheats not much grown, of no great value.

The above winter wheats, cultivated at the Pullman Station of scientific agriculture in 1911, 1912 and 1914, yielded as an average of the three crops from 35.1 bushels (Hybrid 108) to 43.8 bushels per acre (Hybrid 128). Triplet, cultivated only in 1914, gave 53.9 bushels per acre. If the average unit crop produced in a field be taken as 100 for all the wheats tested (with the exception of Triplet), Hybrid 128 gives 105 ; Winter Bluestem 104 ; Hybrid 60, 102 ; Red Russian and Little Club 101 ; the minimum crops were : Forty Fold 89 and Hybrid 108, 84. The percentages differ somewhat, but generally the order of merit remains the same if the results obtained on small test plots are considered. In both instances, Hybrid 108 ranked last.

The analyses of wheats grown on plots in 1914 under uniform conditions gave the results set out in the accompanying table. The last column was calculated in the following way : taking the value of the average of each of the vertical columns as equal to 100, the percentage of flour, gluten and nitrogen was recalculated for each variety, and it was assumed that the average of these three percentages represents the percentage which expresses the quality value.

860 – **Injuries to Rye and Wheat Grain produced by Threshing, and their Consequences.** — WALLDEN J. N., in *Sveriges Utsädeförenings Tidskrift*, XXVIth Year, Part 1, pp. 24-47, 8 tables, 2 figs. Malmö, 1916.

Experiments carried out by the writer prove that the injury caused to grain by threshing, even if very slight, reduces the vitality of the grain, rendering it very sensitive to the action of copper sulphate used for seed disinfection. This sensitiveness is found especially in grain put through ordinary threshing machines. It decreases on the other hand when a small special threshing machine is used, as at Svalöf, and it completely disappears in grains husked by hand. In the latter case, the germination capacity of the grains is not even affected by the use of 10-25 % solutions of copper sulphate.

By means of a new method, of which a description is given later, it was possible to ascertain accurately the location and extent of the injuries in a very large number of grains of different origins. The grain is thus divided into 3 classes : (*a*) grain without injury ; (*b*) with light injury ; (*c*) with severe injury. The sensitiveness of the grain in relation to formalin and copper sulphate varies considerably for the 3 categories, as may be seen from Table I.

The injuries produced by threshing also considerably affect the keeping properties of the grain, particularly when the latter has a large content of water and is exposed to high temperatures. Thus, for recently cropped

TABLE I. — *Sensitiveness of injured or uninjured grain to formalin and copper sulphate.*

| Varieties | Extent of injury | Germination capacity | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Untreated grain | | | Grain treated with a 0.3 % solution of formalin | | | Grain treated with a 2 % solution of copper sulphate | | | |
| | | germinated % | not germinated % | dead % | germinated % | not germinated % | dead % | germinated normally % | germinated abnormally % | not germinated % | dead % |
| Wheat « Thule 3 » . . | 1/1 | 100 | 0 | 0 | 58 | 3 | 39 | 65 | 21 | 4 | 10 |
| » » . . | 1/2 | 92 | 8 | 9 | 79 | 0 | 21 | 67 | 26 | 5 | 2 |
| » » . . | 1/4 to 0 | 79 | 21 | 0 | 94 | 4 | 2 | 89 | 2 | 9 | 0 |
| Wheat « Våperl » . . . | 1/1 | 100 | — | — | — | — | — | 2 | 54 | 0 | 44 |
| » » . . . | 1/2 | | | | | | | 9 | 67 | 0 | 24 |
| » » . . . | 1/4 | | | | | | | 42 | 54 | 0 | 4 |
| » » . . . | 0 | | | | | | | 84 | 16 | 0 | 0 |

TABLE II. — *Reduction of germination capacity sustained in 2 weeks by injured rye grains.*

| Varieties | Percentage of grains in each class of injury | | | | Germination capacity of whole of grains | Germination capacity in each class of injury | | | | Percentage of dead grains in each class of injury | | | | Moisture % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1/4 | 1/2 | 1/1 | | 0 | 1/4 | 1/2 | 1/1 | 0 | 1/4 | 1/2 | 1/1 | |
| Rye Stiärn N. 40 . . . . . | 0 | 51.0 | 45.5 | 3.5 | 98.0 | — | 99.0 | 95.5 | 71.5 | — | 1.0 | 4.5 | 18.5 | 19.5 |
| » » » 7 . . . . . | 0 | 38.5 | 46.0 | 15.5 | 84.0 | — | 97.5 | 87.5 | 35.5 | — | 2.5 | 22.5 | 64.5 | 19.5 |
| » » » 19 . . . . . | 0 | 0 | 75.0 | 25.0 | 74.0 | — | — | 68.0 | 36.0 | — | — | 32.0 | 64.0 | 19.3 |
| » » » 30 . . . . . | 0 | 22.5 | 71.5 | 6.0 | 100.0 | — | 100.0 | 98.0 | 100.0 | — | 0 | 2.0 | — | 15.0 |
| Rye Midsommar . . . . . | 0 | 14.0 | 63.0 | 23.0 | 77.0 | — | 93.0 | 79.5 | 61.0 | — | 7.0 | 20.5 | 39.0 | 20.0 |

rye, the badly damaged grain loses a great portion of its germination capacity in 2 weeks (cf. Table II).

The same observations have been made for wheat by testing machine threshed and hand-husked grain.

The method contrived by the writer for rapidly ascertaining the extent of the injuries sustained consist in submerging the grains to be examined in an 0.4 % solution of eosin, and afterwards washing them in water. Where there is a break in the continuity of the integument, the eosine is absorbed, and communicates a conspicuous red hue to the injured portion. For graduating the extent of the injury the following scale has been adopted : O, no

visible or very slight colouring; ¼, colouring at end; ½, one half at least of the surface of the embryo is strongly coloured; 1/1 the entire surface of the embryo is strongly coloured. This very simple system allows the farmer to determine with sufficient accuracy to what extent the injury produced by threshing can impair the germination faculty and the keeping property of grain.

STARCH CROPS

861 – **Cultural, Food and Industrial Value of some Varieties of Potato tested in Hungary.** — Szell L. (Chair of Chemistry and Technology of the Royal Hungarian Agricultural Academy at Debreczen), in *Kisérletügyi Közlemények* (Bulletin of Hungarian Scientific Agricultural Stations), Vol. XVIII, Part 3, pp. 659-666, tables. Budapest, 1915.

Experiments carried out in 1914 on the test fields of the agricultural Academy of Debreczen, with the 6 varieties of potato — Up to Date, Richter Imperator, Silesia, Böhms' Erfolg, Jubel and Record — planted after autumn rye, in compact sandy soil at about 19 ½ ins apart. The varieties Jubel, Record, Böhms' Erfolg and Silesia were greenmanured in the autumn, and in the spring given a dressing of 232 lbs. of superphosphate and 155 lbs. of potash salts (40 %) per aere; Up to Date and Imperator received only green manure. The monthly rainfall and average daily temperatures varied as follows from the beginning of April to the end of October.

| | Rainfall | Temperatures | | Rainfall | Temperatures |
|---|---|---|---|---|---|
| April . . . . | 17.1 mm | 11.6°C | July . . . . | 80.5 mm | 21.2° C |
| May . . . . | 32.4 | 11.6 | August . . . | 34.7 | 19.9 |
| June . . . . | 110.6 | 18.4 | September. . | 61.8 | 13.3 |
| | | | October . . . | 70.6 | 9.1 |

Particulars with regard to time of plantation and crop, and also content of starch and dry substance, are contained in Table I,

Table I. — *Yields of the Different Varieties.*

| Varieties | Date of: | | Yield of tubers — cwts per acre | | | Average content of: | | Yield of starch and dry matter — cwts per acre | |
|---|---|---|---|---|---|---|---|---|---|
| | Plantation | Crop | 2nd class small tubers | 1st class large and medium tubers | Total | Starch | Dry matter | Starch | Dry matter |
| Up to date . . . | 16 IV | 19 X | 79.93 | 15.91 | 95.84 | 20.0 % | 25.8 % | 19.17 | 24.73 |
| Imperator . . . . | » » | 19 X | 99.38 | 38.33 | 137.71 | 19.8 | 25.6 | 27.26 | 34.55 |
| Jubel . . . . . | » » | 8 IX | 105.54 | 78.44 | 183.98 | 20.7 | 26.5 | 36.67 | 46.95 |
| Record . . . . . | » » | 8 X | 90.88 | 53.13 | 144.03 | 21.8 | 27.6 | 31.38 | 39.73 |
| Böhm's Erfolg . . | » » | 9 X | 105.73 | 85.26 | 190.99 | 20.8 | 26.6 | 40.88 | 52.28 |
| Silesia . . . . . | » » | 9 X | 91.30 | 96.33 | 187.68 | 20.7 | 26.5 | 38.84 | 49.73 |

The Record variety leads in regard to starch content. Next follow in order of importance: Böhm's Erfolg, Jubel, Silesia, Up to date and Imperator. For yield of starch per unit of area the first place is taken by Böhm's Erfolg, followed by Silesia, Jubel, Record, Imperator and Up to Date.

Among the 3 different sizes of tubers (large, medium, small) of the same variety, the maximum difference in the starch content was 5.3 % (Up to Date) and the minimum 0.7 % (Record). The starch content of the small tubers was much below that of the large. On the other hand, the difference beween the starch content of the large tubers and that of the medium was small (these particulars are combined in a table).

In order to ascertain the cooking qualities, the following method was used : After marking all the varieties with a pin, some tubers of similar shape were put into a pot, covered with cold water and slowly cooked on an electric stove, the water not reaching the boiling point until 2 ½ hours had expired. During boiling the potatoes were tested at intervals by means of an iron wire 2 mm. in diameter. They were regarded as cooked when the iron wire passed through 2 tubers at once under a slight pressure, and when, on being cut open they showed all the properties of normally cooked potatoes. The roasting quality was determined as follows: 5 equal tubers of each kind marked were placed in an oven heated to 100° C., the temperature of which was afterwards raised during one hour to 150° C. and kept at this until the end of the tests ; the potatoes taken out from the oven were regarded as thoroughly roasted when the iron wire passed through the tuber easily and divided it into two halves, the latter then showing all the properties of a well roasted potato.

TABLE II. — *Cooking Qualities of the Different Varieties.*

| Varieties | Classification of hardness compared with raw state | Boiling capacity | | | Roasting quality | Taste | Substance |
|---|---|---|---|---|---|---|---|
| | | Temperature maximum | Number of minutes required for boiling | Number of minutes afte which tubers crack | Number of minutes required for roasting | | |
| Up to date . . | 1 max. | 87° C | 68 | 70 | 83 | excellent | very fine, floury |
| Imperator . . | 2 | 87°.5 | 71 | 81 | 165 | fairly good | fine, » |
| Jubel . . . . | 5 min. | 88° | 74 | 79 | 137 | very good | very fine, » |
| Record . . . . | 3 | 91° | 101 | 92 | 105 | good | fair, » |
| Böhm's Erfolg | 2 | 89° | 87 | 106 | 150 | fair | fair, » |
| Silesia . . . . | 4 | 90° | 94 | 117 | 86 | unsatisfactory | fair, waxy. |

The comparative method adopted for determining the cooking qualities and flavour of potatoes made it clear, as seen from Table II, that the "Up to Date" variety was superior to the others, being the best for human food, after which come the varieties Jubel, Imperator and Record, which may be used for human food; the sorts Böhm's Erfolg and Silesia, being unsuitable for food purposes, must be classed among potatoes which can be used for industrial objects.

862 – **Influence of Excess of Water in the Soil during the Second Half of the Summer, on the Formation of Secondary Potato Tubers and their Starch Content.** — ARKHANGELSKIJ M. in *Сельское Хозяйство и Лѣсоводство* (Agriculture and Sylviculture), Vol. CCL, LXXVIth Year, pp. 400-406. Petrograd, March 1916.

The formation of secondary tubers of the potato (excrescences of the tuber) is a phenomenon which often occurs, according to Prof. FRUWIRTH, in those years when excessive humidity of the soil follows a period of drought at the moment when, in normal years, ripening of the tubers takes place. Having observed this phenomenon in different varieties of potato, in his experiments conducted in 1914 and 1915 at the agricultural experiment Station of Tambov (Russia), the writer desired to clear up 2 further points of the question: 1) how does the formation of secondary tubers affect their starch content? — 2) how do the different varieties behave in reference to the phenomenon studied, that is to say, what is the proportion of tubers with secondary growths in the different varieties?

The tubers planted on 1914 and 1915 were grown from varieties bought in 1913 in one of the best known farms in the government of Riazan. The following is a summary of the most important results of the experiments carried out.

I. — *Influence of Humidity.* — From the weather records it is evident that during the first half of the summer, that is until the middle of July, the rainfall and consequently the amount of moisture in the soil were normal both in 1914 and 1915. On the 20th, 21st and 22nd July 1914 and the 14th July 1915, however, there were such heavy falls of rain that they exceeded the quantity which had fallen in 2 months in the previous years; and others followed, so much so that the moisture of the soil reached a very high degree. After the crop it was found that the tubers of all the potatoes exhibited excrescences from the body of the tuber. Such excrescences occurred in two forms: 1) a shrinkage occurred separating the oldest part of the tuber covered with the rough skin from the newest part with a fine glossy and easily detached skin; 2) or a crop of secondary tubers formed, small and arranged in various ways on the principal tuber, being very easily detached therefrom.

II. — *Behaviour of the Different Varieties of Potatoes with regard to the Excrescences.* — A detailed analysis of the crop led to the conclusion that the different varieties experimented on did not all produce the same proportion of malformed tubers, *i. e.* tubers with excrescences. In order to determine this difference more accurately, the percentage of malformed tubers for each kind was calculated from their number in a given quantity of potatoes. In 1915 these data were completed by also estimating the percentage

TABLE I. — *Formation of Excrescences on the Tubers in the Different Varieties of Potato.*

| Names of varieties | Percentage of deformed tubers in relation: | | |
|---|---|---|---|
| | to the total number of tubers tested | | to the total weight of tubers tested in 1915 |
| | in 1914 | in 1915 | |
| *Kitchen Garden:* | | | |
| Local white | 65.4 | 70.3 | 76.2 |
| Elongated Royal | 39.3 | 39.6 | 39.5 |
| "Feia" | — | 28.6 | 35.9 |
| "Delicatesse" | 29.5 | 28.5 | 33.3 |
| Rose de neige | — | 25.0 | 32.7 |
| Duchess of Cornwall | — | 25.0 | 31.9 |
| Local red | 12.0 | 21.5 | 28.4 |
| Ever good | 19.0 | 15.2 | 18.1 |
| *Kitchen Garden and Industrial:* | | | |
| Jubel | 65.9 | 45.0 | 56.0 |
| Prof. Woltmann | 35.2 | 34.8 | 36.2 |
| Prof. Maercker | 63.2 | 25.3 | 29.5 |
| Piast | 47.9 | 23.7 | 32.1 |
| Leon | 37.6 | 18.2 | 26.2 |
| A. switez N. 101 | 6.6 | 9.8 | 12.3 |
| "Devant le front" | 3.1 | 8.9 | 9.3 |
| *Industrial:* | | | |
| Richter's Jubilee | 43.3 | 52.0 | 63.8 |
| Alcohol with violet flowers | 76.6 | 40.5 | 53.4 |
| Brocken | 20.5 | 32.0 | 31.4 |
| Prince Bismarck | 17.3 | 21.8 | 13.7 |
| Grif | 18.4 | 20.9 | 26.1 |
| Silesia | 36.1 | 17.7 | 24.4 |
| New Emperor | 18.8 | 14.1 | 16.5 |
| Sas | 6.1 | 6.3 | 10.8 |
| *Forage:* | | | |
| White Elephant | 50.5 | 42.7 | 56.5 |
| Blue Giant | 20.0 | 20.5 | 25.4 |

of malformed tubers relatively to the weight. The results of these determinations are summed up in Table I, where in each group the varieties are in decreasing order of the proportion of malformed tubers.

The figures given in Table I and the other observations made on the cultivations in question lead the writer to suppose that the capacity of resistance to the formation of excrescences is a property of race, which can be fixed by selection, and tests in other localities and on other varieties would be highly desirable in view of the economic importance of the potato.

III. — *Loss of Starch due to Excrescences.* — The determination of the percentage of starch by means of the REIMANN balance showed marked differences between the malformed tubers and those of regular shape.

Table II sums up the particulars in reference to the industrial varieties, the varieties being arranged in decreasing order of the losses of starch sustained.

TABLE II — *Losses of Starch due to Tuber excrescences in Industrial Varieties*

| Varieties | Loss of starch | Varieties | Loss of starch |
|---|---|---|---|
| "Devant le front" . . . . | 4.3 % | Brocken . . . . . | 1.4 % |
| Silesia . . . . . | 3.9 | Grif . . . . . | 1.4 |
| Sas . . . . . | 2.8 | Richter's Jubilee . . | 1.1 |
| Ever good . . . . . | 2.6 | Prof. Wohltmann . | 0.4 |
| Prince Bismarck . . . . . | 2.2 | New Emperor . . . | 0.2 |

863 - **Comparison between the Effects of Manuring Potatoes with Nitrate of Soda and Sulphate of Ammonia** (From the Agricultural Experiment Station of Radomysl, Russia). — ZASUKHIN A., in *Хозяйство* (The Farm), XIth Year, No. 17-18, pp. 297-304. Kiev, May 1916.

Experiments carried out at the Agricultural Experiment Station of Radomysl in sandy soil, *i. e.* poor in nitrogen, and for which nitrogenous manure is of great importance. Two nitrogenous manures were studied: nitrate of soda and sulphate of ammonia. The trials made with the latter manure are particularly important because, owing to the present war, the importation of nitrate of soda into Russia has greatly diminished, while large stocks of sulphate of ammonia have accumulated, and the extensive use of the latter in agriculture is imperative.

In order to make this comparison between the effects of nitrate of soda and those of sulphate of ammonia, the manure was used in two different ways: sown directly on the tubers during planting or spread before this operation. In addition, nitrogen was given to one plot, half in the form of sulphate of ammonia before planting and the other half in the form of nitrate of soda during planting. The manure was put down in this latter way in order to allow for the facts indicated in the literature of the subject as to the injury caused by sulphate of ammonia, as an acid salt, and as to the retention of nitrate of soda by the soil. By applying the sulphate of ammonia to the soil, before plantation, it was desired to combine the most favourable conditions for the utilisation of this manure, as the plant was thus enabled to offer a better defence against its injurious action. By

putting the nitrate of soda on the tuber itself, it was meant to make its utilisation more immediate and thus prevent its being washed away.

In these tests each plot had received per acre 54 lbs of $P_2O_5$ in the form of slag and 40 lbs of $K_2O$ in the form of a potash salt. A control plot was left without nitrogenous manure. To all the other plots manure was given in equal quantities, *i. e.* 396 lbs of nitrate of soda or 264 lbs of sulphate of ammonia. During the experiments not only was a determination of the crop yield made, but many observations on the growth of the plants were carried out. At the end of May the number of germinated plants was calculated, and then every 10 days the height of the aerial parts of the plant was measured. In addition, at the end of the field, from each plot 10 plants were taken, and there were determined : 1) the quantity and weight of the tubers ; 2) the quantity and weight of the stalks of each plant ; 3) the weight of the aerial parts of each.

The most important results of these experiments are summed up in the appended Table.

*Results of Experiments.*

| Manures used in addition to 54 lbs. of $P_2O_5$ as slag and 44 lbs. of $K_2O$ as potash salts | Yield of tubers cwt. per acre | Excess due to the addition of nitrogenous manure cwt. per acre |
|---|---|---|
| None | 46.22 | — |
| Nitrate of soda, 161 lbs., sown | 73.09 | 25.94 |
| Nitrate of soda, 161 lbs., on the tubers | 75.39 | 28.24 |
| Sulphate of ammonia, 107 lbs., sown | 79.02 | 30.875 |
| Sulphate of ammonia, 107 lbs., on the tubers | 85.40 | 38.25 |
| Nitrate of soda, 80 lbs., on the tubers<br>Sulphate of ammonia, 54 lbs., sown | 76.49 | 29.34 |

The comparison between the figures of the Table and the observations made points to the following conclusions :

1) Sulphate of ammonia gave a larger yield as compared with nitrate of soda.

2) A bigger crop was obtained by applying sulphate of ammonia to the tuber than by spreading it before planting.

3) By applying the dressing of nitrate of soda to the tuber, the development of the potato in its first period of growth was considerably retarded. As regards the crop, it appears nearly equal, whether the nitrate of soda is applied to the tuber or is spread before planting.

4) By giving half of the nitrogen in the form of nitrate of soda to the tuber, and the other half in the form of sulphate of ammonia to the soil

where it is spread before sowing, no advantage was secured as compared with manuring the potato with sulphate of ammonia alone.

For a more accurate interpretation of the results of these tests, it should not be forgotten that the spring and the first half of the summer were very dry.

CROPS YIELDING OILS, DYES AND TANNINS

864 - **Wild Oil Plants of Para, Brazil.** — *Chacaras e Quintaes*, Vol. XIII, No. 5, pp. 322-323. S. Paulo, May 15, 1916.

MR. C. PESCE, of Cametá, Para, Brazil, has for several years been studying the oil seeds of the forests and islands in the estuary of the Amazon. He reports the following species, which he uses in his factory of vegetable oils and soaps, and of which he exports part to Europe. This list proves that Para is exceptionally rich in wild oil plants.

*Carapa procera* (=*C. guyanensis*) ("andiroba"); its fruit furnishes an oil used in the manufacture of soap, lubrication and lighting oils, but as it contains a bitter principle it is not edible.

*Myristica* (*Virola*) *Bicuhyba* ("ucuhuba") furnishes a very thick tallow containing a large proportion of stearin, suitable for the manufacture of soap and candles, and, after purification, for food.

*Astrocaryum vulgare* ("tucumâ") yields products similar to those of *Elaeis guineensis*, namely a pericarp oil ("oleo de palma") and a kernel oil ("oleo de palmito"), but its fruits are 10 times bigger than those of the oil palm. — *Astrocaryum Jawary* ("jawary") also yields a pericarp oil and a kernel oil. On the other hand, *A. Mumbaca* ("mumbaca"), *A. peruvianum* ("huycungú"), and *A. rostratum* only furnish an oil extracted from the kernel.

*Bactris major* ("marajá assú"), *B. minor* ("marajá") and *B. goenomoides* ("marajary") have an oily kernel.

*Oenocarpus distichus* ("bacaba"), *O. minor* ("bacobinha"), *O. multicaulis* ("ciambo"), *O. Batana* ("patana") and *Oenocarpus* sp. n. ("bacabão") have seeds which yield a very fine edible oil much superior to that of cotton seeds, but in small quantity only.

Many species of *Altalea* produce kernels which give very high percentages of an edible oil, very sweet, resembling that of the coconut.

*Cocos Inajai* (= *C. equatorialis*) ("jarená") and *C. Syagrus* ("pororema") supply an oil almost equal to that of *C. nucifera*.

*Pentaclethra filamentosa* ("pracaehy") furnishes an edible oil in abundance.

*Pachira aquatica* ("mamorana") yields a highly aromatic and edible fat.

*Erisma calcaratum* ("caramurú" or "jaboty") supplies a very thick fatty substance.

*Lippia* (*Platonia*) *insignis* ("bacury") yields a somewhat resinous fatty substance.

*Bertholletia nobilis* (=*B. excelsa*) ("castanha do Pará") and *Lecythis usitata* ("sapucaia") produce an oil very similar to that of sweet almonds.

*Dipteryx odorata* ("cumarú") supplies a very delicate aromatic oil in abundance.

*Bombax Munguba* (" Monguba ") and *Eriodendron anfractuosum* (= *Ceiba pentandra*) (" sumauma ") yield seeds which furnish an oil similar to that of cotton.

*Guilheminea speciosa* (" pupunha ") has fruits of fine flavour the seeds of which furnish an abundance of oil similar to that of the coconut.

*Sapindus Saponaria* (" saboeiro "), very common in the Lower Amazon ; its fruits have a skin which contains about 30 % of saponin, from which a highly esteemed soap is made ; its kernel yields an edible oil very like that of the olive.

*Hevea brasiliensis* (" syringa ") produces a drying oil.

*Sacoglottis Uchi* (" uchy ") furnishes an edible oil.

*Poraqueiba serica* (" umary "), from the pericarp a highly aromatic oil is extracted.

*Theobroma microcarpa* (" cacao-rana "), *T. speciosa* (" cacao-y "), and *T. grandiflora* (" cuprassú ") provide aromatic substances. Their fats are also used as a substitute for cocoa.

*Matisia paraensis* (" capuassurana ") produces oil.

*Copaifera guyanensis* (" copahyba ") furnishes the well known medicinal oil on tapping the tree.

*Sacoglottis amazonica* (" uchy-rana "), *Symphonia globulifera* (" anany ") and *Rheedia macrophylla* (" bacury-pary ») furnish copal and oleo-resin.

The Author points out that he only enumerates the most important and most common plants in the State of Para, and he also gives a list of several other plants the botanical identification of which has not yet been carried out.

865 – **Description of the Varieties of Sugar Cane under Extensive Cultivation.** — JESWIET J., in *Mededeelingen van het Proefstation voor de Java-Suikerindustrie, Archief voor de Suikerindustrie in Nederlandsch Indië*, XXIVth Year, Parts 12 and 13. Soerabaja, March and April 1916. SUGAR CROPS

The importance is emphasised of a good description of the different varieties of sugar cane under extensive cultivation, with a view to ascertaining their individual characteristics, preventing a mixture of the cuttings (" bibit ") used on the plantations and obtaining a guarantee of purity and origin. Besides this, the inspection of the plants and examination of the cuttings imported or purchased from nurserymen is only possible if a precise description of the known varieties is available.

The different proposals of other writers who have dealt with the question of systematising the knowledge of the sugar cane are reviewed and rejected, owing both to the insufficiency and the inconstancy of the characters described.

In the form of the internodes, their colour and the mode of insertion of the leaves, some fairly fixed and absolute distinctive characters were found in the sugar cane from 4 to 9 months old. It is chiefly however in the form of the buds and also the distribution of the hairs over the outer scales of the buds and on the different parts of the leaves, that a sure means has been discovered for identifying the different varieties and combining them in certain groups representing the same characters and probably of the same origin.

A description is given of the 2 most important varieties of sugar cane grown from seeds in Java and designated by the numbers 247 B and 100 P. O. J.

The origin of No. 247 B. is somewhat doubtful and it is probably to be attributed to a cross of the Fiji cane with the Cheribon cane as the female parent.

The variety 100 P. O. J. was obtained by accidental hybridisation of the original black Borneo cane, probably with the Loethers cane. The writer believes that the latter may be identified as the male parent on comparing different characters of the cane 100 P. O. J. with those of the Loethers variety.

A minute description is given of the various morphological characters of these 2 varieties, on the basis chiefly of the insertion and dispersion of the hairs over the buds, and on the shape of the internodes.

866 – **The Problem of Nitrogenous Manuring of the Sugar Cane in Java (Sulphate of Ammonia or Oil Cakes ?); Results of 10 Years of Experiments.** — GEERTS J. M., in *Mededeelingen van het Proefstation voor de Java-Suikerindustrie, Archief voor de Suikerindustrie in Nederlandsch-Indië*, XXIVth year, Part 14. Soerabaja, April 1916.

The importation of sulphate of ammonia generally used for manuring the sugar cane having become very uncertain and difficult, the question of finding a substitute for it is one of primary importance. It appeared possible to find the solution of the problem by making a digest, from one and the same point of view, of all the results obtained for 10 years of experimental manuring of the sugar cane in the field and calculating them uniformly. This has now been done, and the results given by earthnut cakes have been compared with those yielded by sulphate of ammonia.

The conclusion reached is that the former cannot be deemed equal to the latter. A mixture of the two manures gives better results than the use of oil cakes alone.

In rather sandy soils, the oil cakes produce better results than in clayey soils. The nitrogen in sulphate of ammonia not being so expensive as that in oil cakes it is more economical to use the former.

The production of the sugar cane is less when oil cakes are used than with sulphate of ammonia, but the richness in sugar is not affected.

867 – **A Pre-fermentation in Special Stacks of Tobacco.** — DE VRIES O., in *Mededeelingen van het Proefstation voor Vorstenlandsche Tabak*, No. XXIII, pp. 69-88. Semarang, 1916.

In 1914 the tobacco-growing season in a part of Java was marked by great dryness.

The tobacco harvested during these times of drought frequently shows traces of the pressure undergone after fermentation, these traces remaining visible in the form of streaks and spots on the leaves when put up into bundles for the market.

Experiments were made in 1914 to remedy this drawback, which considerably reduces the value of the tobacco. Fermentation stacks were designed the centre of which remained empty, and in which the air could circulate more freely than in the ordinary form of stack. Taking care that the

temperature in these stacks should not exceed 35° C., the results obtained were very satisfactory.

Subjecting the tobacco thus treated to the usual fermentation hardly any trace of pressure could be observed. It is thought that this result may be interpreted as pointing to a slow oxidation, which during the process of slow death of the leaves in the preliminary stacks, destroys certain essential oils which, owing to rapid heat, such as occurs in the ordinary stacks (where the temperature frequently reaches 54° C.), are decomposed, The products of decomposition, impregnating the dry cells, form pressure spots on the leaves, which marks persist during all the subsequent operations of handling the tobacco.

868 – **Investigations into the Combustibility of Tobacco.** — I. De Vries O., Method of Research. — II. De Vries O., Influence of Manure on the Combustibility of Tobacco. — III. Sidenius R., Enquiries into the Combustibility of Tobacco, in *Mededeelingen van het Proefstation voor Vorstenlandsche Tabak*, No. 22. Semarang, 1916. FRUIT GROWING

Combustibility is first of all defined as : " *the time occupied in the combustion of a leaf of tobacco stretched horizontally and ignited near its central part.* " At the same time the colour of the ash in small cigars made with tobacco of the same origin and allowed to burn themselves out was observed. A scale of colours facilitated an estimate of the differences.

According to the results from the experimental fields where the tobacco was treated with different manures, no influence of the manure on combustibility was observed.

It seems as though the properties of the soil and the climate have a predominating influence. A tobacco originally defective in combustibility cannot be improved by a special manure. Only a potassic manure in large quantities, which is then very expensive, may sometimes produce good results. Thus, a dose of 0.75 oz. (20 grams) of nitrate of potash per plant produced some effect.

Flooding of the tobacco fields occasionally during periods of drought may considerably impair combustibility.

A lesser combustibility was found in the leaves near the top as compared with those at the end, especially if the rains do not fall until near the end of the cultivation.

The attempt was made to inject potash salts into the plants, but without positive results.

869 – **Attempted Classification of Pears.** — Chasset Louis. Compte-rendu par Gabriel Luizet, in *Journal de la Société Nationale d'Horticulture de France*, 4th Series, Vol. XVII, pp. 74-78. Paris, May 1916.

The idea of classifiyng and determining these fruits was first dealt with by Robert Hogg in 1851, then renewed by him in 1884 in reference to apples only. In France, Willermoz made the greatest effort in this direction. In 1912, at the French Congress of Apple Growers at Limoges, two writer Jules Jouin and Louis Chasset, each submitted a preliminary scheme differing little from each other, although carried out at 600 kilometres distance without any consultation.

M. Louis Chasset carried his scheme into effect. According to his method, the pears are first of all studied as regards the dimensions in height and breadth.

*First class* : Fruit of the same breadth as height.
*Second class* : Fruits broader than they are high.
*Third class* : Fruits higher than they are broad : 1/10 to 2/10, 3/10 to 4/10.
*Fourth class* : Fruits higher than they are broad : 4/10 and more.

The first and second categories comprise the following forms : *spheriform, short turbiniform, short doliform, short cydoniform, maliform and flattened turbiniform.*

The third class comprises: *doliforms, ovoids, turbiniforms, truncated turbiniforms, piriforms, truncated piriforms and cydoniforms.*

The fourth class comprises the last forms adopted : *long piriforms, calebassiforms and oblongs.*

In each of these forms, 21 periods of ripening were created : June, June-July, July-August, etc.

Each of these times of ripening presents a picture in which the colours of the skin of the fruit are noted ; these colours are: dark green, light green, reddish, russet or bronzed ; the yellowish colour put down at first was afterwards struck out as being useless.

After the colour of the skin the next thing dealt with is the stalk, which is divided from the point of view of dimensions into long, medium or short; and of consistency, into fleshy or not fleshy at the base ; and of position, into straight, oblique or arched.

Carrying the selected characters still further, the flesh is next examined as to its colour : white, yellowish, greenish, salmon ; then as to its taste : sweet, acid, wine, musk, tart.

The complete work comprises 5 volumes, the contents of which have been condensed into a single volume which forms a popular edition. Mr. Chasset, in order to facilitate this demonstration to the public, has prepared 8 tables, summing up the whole of his work. Thanks to these tables, various fruits were classified with great facility and rapidity by a meeting to which Mr. Chasset submitted his work.

870 - ***Pyrus calleryana*, an Interesting Species of Pear Tree.** — Reimer, F. C., in *The Monthly Bulletin of State Commission of Horticulture*, Vol. V, No. 5, pp. 166-171, 2 fig. Sacramento, California, May 1916.

In 1908, Mr. George Compere, during a voyage in China, was struck by the resistance of a species of pear tree to " pear blight " or necrosis of the bark of the branchs (*Bacillus amylovorus* [Burr.] De Toni); he therefore introduced this species into California, believing it to be the " Chinese sand pear ", *Pyrus sinensis* Lindl. The writer has studied this pear tree, and found that it was not *P. sinensis* but the species *Pyrus Calleryana* Decaisne. *P. Calleryana* occurs very widely in China, where it is found both in the south, the east, the centre and the west. It grows at all altitudes up to 5000 feet. It is distinguished from *P. sinensis* by its leaves, which are relatively shorter, wide, with rounded or widened base, and with rounded or crenate teeth along the edges. In addition *P. Calleryana* generally has

3 or 4 carpels, rarely 2 or 5, while *P. sinensis* generally shows 5, rarely 3 or 4.

*P. Calleryana* has been found highly resistant to pear blight. Inoculation trials carried out by the writer showed that the species, if not absolutely immune, is at any rate very little affected; if the infection develops in the one year old wood, it never gets as far as the two or three year old wood.

In no case does it develop in branches with a diameter exceeding half an inch. A two year old *P. Calleryana* was inoculated at the end of both soft and vigorous branches, as well as in the trunk. The disease did not appear in the trunk, while it did develop in the *P. communis* used as control and inoculated in the same way.

The writer's opinion is that the species in question has not received all the attention it deserves from the point of view of fruit production. At the Southern Oregon Experiment Station, which has perhaps the largest collection of pear tree species in the world, *P. Calleryana* was quite successfully grafted on *P. communis* as well as *P. sinensis*. As soon as the writer has sufficiently large seedlings of *P. Calleryana* he will shield-graft them on different varieties of *P. communis*.

871 - **The Orange Tree in Algeria.** — TRABUT L. in *Bulletin Agricole de l'Algérie-Tunisie-Maroc*, 2nd Series, 21st Year, No. 11, pp. 273-278. Algiers, Nov. 1915.

For some years past the Algerian colonists have been actively growing the orange, and when seeking for information and guidance in reference to starting an orange plantation, they sometimes meet with discordant views. The writer proposes to correct some current errors.

It is asserted that the orange tree will not grow as far down as the Sahara, while according to the writer's testimony there are no better oranges than those gathered in some oases. The " Biskra Blood Orange ", which has been grown in that oasis for some years now, is delicious, and fetches very high prices. In the Djerid there are also excellent oranges, and the writer brought back a thoroughly first-class variety from Deggaeh; The free orange stocks there are very fine and covered with fruit; they thrive well beneath the date trees. In the oases, it would be necessary to make provision, as elsewhere, for a grafting stock possessing resistance to gummosis of the tree-foot, which is not done by the natives, who simply sow sweet oranges or graft on to a lemon tree; which makes certain failures inevitable, above all with basin irrigation.

As regards seed plots and plants, an example is reported from Arba, where a settler who undertook the plantation of 247 acres of orange trees sows his Seville oranges on a hotbed beneath a glass frame, early in February. About the 15th April the young plants are put into tapering pots about 10 ins, in diameter on top, and about 11 ins. in height. These pots are buried in the beds early in June; during the summer they are watered frequently, and every month they are given a few grams of blood and superphosphates. At the end of November the plants may easily reach a height of 23 to 29 ins., and three months later, i. e. 13 months after sowing, they can be planted out and grafted seven months afterwards, about the month of October following planting. These trees grow rapidly, and six years after

sowing they are in bearing, and capable of yielding from 400 to 600 fruits. In no case should the orange tree stem be subjected to persistent moisture; the planting must be done so as to keep the top of the root outside the soil, and to prevent gummosis of the foot of the tree the practice of basin irrigation has been everywhere abandoned.

The General Government of Algeria has for the last twenty years made a collection of the best orange trees from different centres of cultivation : Spain, Portugal, Canaries, Italy, China, Japan, Australia, Brasil, Florida, California, etc. In this collection, a quantity of varieties far superior to those already acclimatised are to be found ; these varieties ripen almost successively from November to June, and answer both the requirements of cultivation and trade and the taste of consumers. It woud be of interest to look for a site in Algeria for grape-fruit or " pomelo ", a *Citrus* which should not be confused with the shaddock to which it very closely approaches. The botanical Station of the General Government successfully grows the best varieties of " pomelo ". *Citrus japonica* or " cumquat " is increasingly used in preserves. The " Washington Navel " orange, which has given excellent results in almost all orange-growing countries, should be recommended for Algeria likewise, and some confusion exists when an introduction dating back more than fifty years is spoken of.

872 - ***Diospyros virginiana*** **(" Persimmon ") in the United States.** — FLETCHER W. F., in *U. S. Department of Agriculture, Farmer's Bulletin*, No. 685, 28 pp., 17 fig. Washington, D. C., October 12, 1915.

This Bulletin gives the following general information with regard to *Diospyros :* Botanical classification, Natural distribution, General description, Possibility of improvement, Methods of spread and cultivation, Diseases and pests, Uses of the tree and its products, Recipes for the preparation of cakes, jams, ices, etc. from its fruits, and List of particular varieties selected and cultivated.

*Diospyros virginiana* was described and much esteemed from the early times of the discovery of North America. It is a native of the south-eastern part of the United States, where it abounds in fields and forests. Some cultivated specimens, however, also did well in the States of Rhode Island and New York, which proves that the northern limits of this species may lie very high when aided by cultivation. The region where *Diospyros* produces most and to which it is best adapted, extends from Maryland, Virginia and the two Carolinas westward through Missouri and Arkansas. It thrives in every description of soil. The species is generally dicœcious. With regard to the habit of the tree, there are 2 types : one with ascending and the other with descending branches ; some fruits are oblong in shape, others are pear-shaped. The period of ripening varies very much : ripe fruits may be obtained from August to February.

The fruit of *Diospyros virginiana* is far from being as much appreciated as it deserves in its native country, in spite of the fact that it is much more nutrient than the ordinary fruits of temperate countries. The only fruit which can be compared with it is the date. In addition to consuming the

fruit raw, household drinks are made from it, and it is eaten by pigs put out to grass and by dogs.

*Chemical composition of the fruit of Diospyros virginiana (average of 6 analyses made in 1896 at the Indiana Station).*

| | |
|---|---|
| Dry substance | 35.17 % |
| Ash | 0.78 |
| Protein | 0.88 |
| Sugar (Nitrogen-free extract) | 31.74 |
| Cellulose | 1.43 |

A description of the following varieties is given: Burrier, Boone, Delmas, Early Bearing, Early Golden, Golden Gem, Hicks, Josephine, Kansas, Miller, Ruby, Shoto and Smeech.

It is advised that *Diospyros* should be grown both by sowing and grafting.

*Diseases and pests* — This species is exceptionally free from diseases and pests. The most dangerous of the latter is perhaps the " hickory twig girdler " (*Oncideres cingulata* Say), the larva of which bores tunnels in the wood of the young branches. The injury is caused by the mode of oviposition. The adult devours a small amount of bark, generally immediately above or below a bud, and by means of the ovipositor inserts the egg beneath the bark. Generally, several eggs are thus laid alongside each other, so as to form a ring-shaped incision which causes death and fall of the ends of the young branches. For control it is necessary, in June or the beginning of July, to collect the small twigs which have fallen to the ground and burn them, so as to destroy the insects inside.

873 – **The Date Palms of Egypt and the Sudan.** — MASON S. C., in *United States Department of Agriculture, Bulletin* No. 271, 40 pp., 9 fig. + XVI tables. Washington, D. C., September 28, 1915.

The first date seeds imported into the United States came from Egypt. As great confusion exists in the classification of the varieties of this great date-producing region, so much so that the identification of some of the best varieties tried in the United States (Palm woods of Tempe and Mecca) is rendered doubtful, the Research Office in connection with the selection and physiology of cultivated plants, and the Foreign seeds and plant Importation Office of the United States Department of Agriculture, sent the writer, in August 1913, to Egypt and the Soudan to study the varieties of date trees. In the above Bulletin the writer described 22 varieties in Egypt and the Soudan. They comprise the majority of those having any commercial importance, and also several others of less importance but which had hitherto not been described.

The cultivation of the date in Egypt and the Soudan dates back to very ancient times. At present these countries possess about 9 000 000 date palms, the production of which is valued at about 4*s*. per tree. No more than one fourth of these trees belong to any of the 12 varieties of commercial importance (Aglany, Amhat, Amri, Barakawi or Ibrimi, Ben-

*Meteorological data relating to the three great climatic zones of Egypt and the Sudan and the varieties of date palms characteristic of each type of climate.*

| Zone and locality | Relative average humidity | Mean temperature in degrees C. | | Units of heat above 18°C. during the period 1st May to 31st October | Varieties of date palms cultivated in the different localities |
|---|---|---|---|---|---|
| | | Annual | From February to October | | |
| *Subtropical seaboard.* | | | | | |
| Alexandria | 68 | 20°.17 | 21°.31 | 1 138 | Aglany, Amri, Bint Aischa, Hayany, Kobi, Samany, Zagloul. |
| Port Said | 74 | 20°.53 | 21°.59 | 1 217 | |
| Gizeh | 69 | 19°.60 | 21°.59 | 1 211 | |
| Abbasia | 62 | 21°.09 | 23°.15 | 1 508 | |
| *Subtropical desert.* | | | | | |
| Bedrashen | — | — | — | — | Amhat, Hamrawi, Hayany, Siwah. |
| Hélouan | 54 | 20°.50 | 22°.52 | 1 442 | |
| Fayoum | — | — | — | — | |
| Siout (Assiout) | 53 | 21°.27 | 23°.38 | 1 748 | |
| Dakleh | 36 | 23°.29 | 25°.78 | 2 042 | Saidy, Sultany, Tamr, Hamrawi, Falig. Barakawi, «Bartamoda», Godeila, «Ibrimin». |
| Assouan | 39 | 25°.17 | 27°.74 | 2 387 | |
| *Tropical desert.* | | | | | |
| Ibrim | — | — | — | — | «Ibrimi», Barakawa, Bentamoda, Gondeila, Kosha, Kulma. |
| Wadi Halfa | 34 | 25°.03 | 27°.52 | 2311 | |
| Merowe | 24 | 26°.58 | 29°.78 | 2 615 | |
| Atbara | 38 | 27°.63 | 29°.42 | 2 475 | |
| Khartoum | 33 | 28°.31 | 29°.83 | 2 442 | |

tamoda, Bint Aischa, Hayany, Saidy, Samany or Rhashedi, Siwak, Tamr and Zagloul). The others are seed trees, producing cheap inferior fruit.

The date cultivation in the Nile valley extends almost uninterruptedly from the Mediterranean coast to Khartoum, for about 1123 miles. This is the tract where, from north to south, it occupies the largest continual extent existing in the world. Bextween Alexandria and Khartoum, which are the outermost points of this cultivation, there is a difference of 10.6° C in the mean annual temperature, and the corresponding mean moisture ranges from 74 % at Port Said to 24 % only in the province of Dongola,

Soudan. For convenience in his work of study the writer divides this regions into three zones : 1) subtropical seaboard, which comprises the delta of the Nile as far as Cairo ; 2) subtropical desert, containing the valley of the Nile from Cairo to Assouan and the western oases ; 3) tropical desert, comprising the parts of the Nile valley where the date is cultivated between Assouan and Khartoum. In the accompanying Table the particulars recorded in 12 meteorological stations of Egypt and the Soudan are condensed, and the varieties of date palms characteristic of each region are grouped. It is seen from this table that 1) the fresh and moist seaboard zone produces few dates for drying and exporting, the production being exclusively dates which are eaten fresh (Bint Aischa, Hayany, Kobi, Samany and Zagloul) ; 2) superior quality drying dates are produced in the moderately hot and dry parts of the subtropical desert zone ; 3) the hottest and least moist part of the subtropical desert zone, and the tropical desert zone, produce almost exclusively the hard dates, self-drying, very easily kept and transported, which make up so considerable a part of the food of the Arab population.

874 - **Raisin Production in the United States.** — HUSSMANN GEORGE C., in *United States Department of Agriculture Bulletin* No. 349, 15 pages, 3 fig. + 9 tables. Washington, D. C., March 17, 1916. VINE GROWING

With the exception of very small quantities produced in Arizona, Utah and New Mexico, all the raisins produced in the United States come from California (1).

The first introduction into California of the species of vines intended for the production of raisins date back to 1851, in which year the Muscat of Alexandria was sown ; in 1861, plants of the stocks of Gordo Blanco and Sultana were imported from Spain, and stocks of red and white Currants from the Crimea.

The first raisins were produced in California in the valley of San Bernardino. In 1873, the production of raisins having amounted to 120 000 lbs., the industry began to assume some commercial importance for California ; the appended summary of the trade shows how rapid its progress was and is. In 1892 the production of California equalled that of Spain ; at present it is about three times as great. The annual consumption of raisins per inhabitant is about 1 $^1/_2$ lbs. in the United States against 5 lbs. in Great Britain.

At present, 110 000 acres are devoted to the growing of grapes to be dried for raisins ; out of 58 countries of California, 11 produce a quantity of any commercial importance, the county of Fresno alone supplies about 60 % of the entire State production. The greater part of the production is yielded by small vineyards of 10 to 50 acres each.

The Alexandria Muscatel, which is the most important raisin stock, always, in addition to the first crop for drying, supplies a good second crop which is made into wines or alcohol, and sometimes a third. The grafting hosts suited to it are, in decreasing order of merit : Riparia × Rupestris 3 309,

(1) See *B.* May 1916, No. 558. (*Ed.*)

*Production and trade in Raisins in California.*

| Year | Production in California | Exports during the fiscal year ending June 30 | | Imports during the financial year ending June 30 | |
|---|---|---|---|---|---|
| | lbs. | Quantities lbs. | Value dollars | Quantities lbs. | Value dollars |
| 1885 . . . . . | 9 400 000 | — | — | 38 319 787 | 2 661 669 |
| 1905 . . . . . | 87 000 000 | 7 054 824 | 372 087 | 4 041 040 | 3 112 985 |
| 1915 . . . . . | 250 000 000 | 24 845 414 | 1 728 547 | 2 802 901 | 2 719 200 |

Riparia × Rupestris 101, Dog Ridge, Riparia × Rupestris 101-14, Berlandieri × Riparia 420 A. Second in order of importance is the Sultana. This vine is well adapted to the following grafting stocks, in decreasing order of merit: Riparia × Rupestris 3 309, Dog Ridge, Aramon × Rupestris Ganzin No. 1, Riparia × Rupestris 101, Lenoir, Solonis × Riparia 1616.

The red Currant or Panariti has been found to be well adapted to: Rupestris St-Georges, Mourvèdre × Rupestris 1202, Aramon × Rupestris Ganzin No. 1, Riparia × Rupestris 3309, Salt Creek and Dog Ridge (arranged in order of merit).

Drying is effected in the sun entirely ; sometimes before drying the grape bunches are washed or steeped in boiling lye (the Author gives two formulae of the latter as used in large establishments).

875 – **Hot Water Treatment of Tree Seeds used in Reafforestation and of poor Germinating Capacity.** — Honing J. A., in *Mededeelingen van het Deli Proefstation*, Xth Year, Part 1, pp. 16-23. Medan, March 1916.

The seeds of *Albizzia moluccana*, *Pithecolobium Saman*, *Mimosa invisa* and *Crotalaria striata* were steeped in warm water at various temperatures in order to ascertain to what extent this treatment would promote germination.

With the seeds of *Albizzia*, the best result was obtained by using water at 60° C. The seeds are dropped into this water, which is then allowed to cool for 3 hours.

For *Pithecolobium* seeds somewhat hotter water (70 to 75°) is preferable.

The seeds of *Mimosa invisa* germinated most easily after a treatment with water at 60-70° C.

With the seeds of *Crotalaria* no advantageous result is obtained by steeping in water.

The above experiments were carried out in Java.

876 – **The Eucalyptus in Algeria.** — Trabut, in *Comptes Rendus de l'Académie d'Agriculture de France*, Second Volume, Year 1916, No. 25, pp. 699-702. Paris, 1916.

As far back as 1862 some plantings of *Eucalyptus* were made in Algeria. There was first some enthusiasm for *E. globulus*, but afterwards preference was given to the Red gum group, and under this name there were propagated *E. rostrata*, *E. rudis* and *E. tereticornis*, often erroneously called *E. resinifera*.

The three species have crossed; they have even hybridised with remoter species, such as *E. botryoides.*

The writer discusses the uses of the *Eucalyptus* and combats the prejudices existing against this tree. Formerly, for instance, its wood was regarded as a bad fuel. The high price of coal however has resulted in trials of wood stoking of furnaces, and it has been found that 563 lbs. of dry branches of *Eucalyptus* can replace 220 lbs. of coal briquettes (1). *Eucalyptus* can also be used for telegraph poles or railway sleepers. Old building frameworks made of *Eucalyptus*, are already in existence. It is also beginning to be esteemed in cart and carriage building. Finally, some very fine " Red gum " furniture places the value of this wood for cabinet making beyond doubt.

The writer points out the following species, indicating the use for which each is best adapted ; *E. globulosus*, very rapid growth in deep soil, utilised in the harbour works of Algiers ; *E. Red gum*, the two hybrid forms *E. algeriensis* and *E. Trabuti* are to be preferred to the original species *E. rostrata*, *E. rudis* and *E. tereticornis ; E. cladocalyx* or *corynocalyx*, highly resistant to drought, upright trunk, very regular, hard wood, is suitable for telegraph poles and railway sleepers; *E. diversicolor or colossea*, the Australian " Karri ", very widespread, same uses as the last named ; *E. gomphocephala*, the Touart, and its hybrid *E. gomphocornuta* Trab., a very fine tree, good wood, rare ; *E. occidentalis*, var. *oranensis*, a fine tree in the salt soils of Oran, abounding in the domain of Habra ; *E. robusta*, with the last named in the salt soil of the domain of Habra ; *E. obliqua* or *gigantea*, fine specimens of the forestry Station of Bainem, light wood, easily worked, attains great growth in deep soils ; *E. maculata* very upright trunk, high, resistant wood, difficult to raise in its young stage ; *E. viminalis*, very fine specimens at Djebel-Ouach, Constantine (altitude 3300 feet) ; the seeds should be gathered here in order to grow the tree at Stations of similar elevation in Djebel-Ouach ; *E. botryoides*, a species presenting numerous varieties, probably hybrids, of fine growth ; a selection of these should be made. In *E. botryoides* the leaves have the normal horizontal position ; this species is much more shady than its fellows ; it is a fine avenue tree, with a very beautiful wood which looks like mahogany.

## LIVE STOCK AND BREEDING.

877 - **Experiments in Control of Livestock Epidemics by means of Methylene Blue.** — RAEBIGER and RAUTMANN, in *Berliner Tierärztliche Wochenschrift*, 32nd Year, No. 22, pp. 253-258. Berlin, 1st June, 1916. HYGIENE

Since December 1913, the writers have been conducting experiments with a view to combating various epidemic diseases of livestock by means of methylene blue (*Methylenum caeruleum medicinale* Höchst), introduced into the stomach of the animals. It is well known that methylene blue tends to

(1) See *B.* July 1916, No. 789. (*Ed.*)

make its way into the bacteria, combining with their cell-contents and afterwards killing the organisms. Very important experiments in this connection have been made up to the present at the agricultural experiment Station of Vermont (United States) for prevention of epizootic abortion in cows. Among 92 cows infected with the abortion bacillus, and to which the methylene blue had been administered, no actual abortion occurred.

The experiments carried out in America were repeated by the writers, but they are not yet able to pronounce an opinion as to their accuracy, the trials not yet being completed. In the treatment of swine fever and infectious enteritis, results have already been obtained which constitute an inducement to continue experimentation with methylene blue on a more extensive scale.

It was first of all observed that 4 pigs evidently ill with fever were cured after a treatment with 0.75 to 1 gr. of methylene blue per day per head. In 4 days an improvement was already observed, and within 3 weeks all the animals were cured. A similar result was secured in other piggeries containing a large number of animals. For the control of infectious enteritis comparatively small doses of methylene blue were used, administered regularly for at least 10 to 14 days. To increase the effect of the internal disinfection, the sties were disinfected every day after removal of the droppings.

To sum up, it may be said that the experiments carried out with methylene blue for the treatment of swine fever and infectious enteritis have shown that cures may be obtained, above all when the disease is located in the digestive organs. In cases of true infectious enteritis with serious pathological changes of the lung, the effect of the remedy was less pronounced ; it seemed if anything to hasten the death of dying animals. When the critical stage of the disease is passed the remedy must not be administered, because its bitter taste tends to reduce the appetite of the animals.

The attempt was also made to ascertain whether methylene blue administered to pigs has a detrimental effect on the fat and the meat. For this purpose, 0.1 gr. of methylene blue per day was administered to a pig of medium weight from the 11th December, 1915 to the 3rd January, 1916 (except from the 21st to the 23rd December), which was then slaughtered.

The post-mortem showed that neither the meat nor the fat were affected and that the symptoms occasioned by the methylene blue were localised in the stomach, where the glandless part particularly was coloured blue. The mucous membrane of the caecum was also slightly blue in colour, but the small intestine in a few places only.

The experiments will be continued by the writers with the support of the Prussian Ministry of Agriculture, at the bacteriological Institute of the Chamber of Agriculture of the Province of Saxony, at Halle a. S.

878 - **Influence of Colour in Horses on the Cure of Mange.** — MASUR, in *Berliner Tierärztliche Wochenschrift*, 32nd Year, No. 25, p. 294. Berlin, June 22, 1916.

When treating numerous cases of mange, it was observed that the colour of the horse has some influence on the cure of the disease. Cure was completed most rapidly in black horses, where often no formation of crusts

even was observed. To cure them it was mostly sufficient to rub them with some ordinary remedy. In bay horses, cure required a greater length of time. In chestnut horses the treatment had almost always to be repeated. In white horses, above all those with a uniform coat, treatment repeated a second time did not always bring about a cure, which observation was confirmed by other veterinary surgeons. These results were not affected, no matter what drug was resorted to for cure.

The writer is at a loss to explain exactly the cause of this phenomenon, but he thinks acarids enter more easily and more deeply into the skin containing no pigment and are thus more difficult to get at by the curative agent than in animals with pigment.

879 – **A Contribution to the Study of the Treatment with Sugar of Surgical Injuries of the Foot in Horses.** — BIMBI PAOLO, in *Il Moderno Zooiatro*, Vth Series, Vth Year. No. 4, pp. 109-115. Bologna, April 30, 1915.

A description of several cases of foot injury which the writer treated with sugar. His observations agree with those of PROF. BUSSANO (1), as regards the absorbent, antiseptic, cicatrising and cleansing powers of sugar. They also prove that sugar possesses the property of promoting the formation both of the soft tissue of the foot and of the horny tissue. As regards this latter property, sugar exceeds all substances in common use hitherto in the treatment of surgical injuries of the foot (SOCIN's powder and paste, naphthaline, carbolic oil, etc.).

880 – **The Importance of Silage in the Economics of Livestock Feeding, on Farms in East Anglia.** — JAQUES G., in *The Journal of the Board of Agriculture*, Vol. XXII, No. 12, pp. 1249-1252. London, March 1916. FEEDS AND FEEDING

The economics of milk and meat production and of livestock feeding generally, during the winter, constitutes at the present time a problem of the utmost importance, especially in East Anglia. The climate there is mainly of a rather dry character, so that the growing of forage roots is uncertain and the farmer is compelled to look for a solution of the problem along other lines, among which the ensilage of green leguminous forage has latterly assumed special importance.

By this means the Author was able, in Norfolk, to produce milk at a cost of about 3 ⅓ *d* per gal. for food, or, roughly half of the cost of feeding with roots forming the basis of the ration. A similar reduction was found in the cost of production of meat and breeding stock.

The saving of nitrogenous manure realised on this method, by using bought phosphates alone for leguminosae grown every other year, is one of the factors having the greatest influence on the economics of production; besides which, owing to the conditions prevailing in East Anglia, saving of labour is no less important owing to its shortage and high cost. The same applies to forage economy in general, above all as regards concentrates as compared with feeding with a basis of roots. The particulars here reproduced as to the cost of silage, its composition, and the method of feeding

(1) See *B.* February 1916, No. 188. (*Ed.*)

it to cattle, were taken by the writer from the accounts kept on his farm in 1915, after 3 years' use of silage. The farm comprises 105 acres of arable second-rate heavy land, and 45 acres of pasture.

*Cost of growing one acre.*

| | £ | s. | d. |
|---|---|---|---|
| Rent | 1. | 0. | 0 |
| Basic Slag | | 12. | 0 |
| Ploughing | | 10. | 0 |
| Harrowing | | 1. | 6 |
| Seed (1 ½ bush. of tares, ½ bush. of beans, 1 bush. of oats, 1 peck of rye) | 1. | 0. | 0 |
| Seeding | | 2. | 0 |
| Rates | | 4. | 0 |
| Steam Cultivating twice after crop is removed | 1. | 0. | 0 |
| Rolling | | | 9 |
| £ | 4. | 10. | 3 |
| Cost of cutting and getting ready one acre for carting | | 11. | 0 |

Cost of filling silo 16ft. by 39ft., capacity 20 tons:

| | £ | *s.* | *d.* |
|---|---|---|---|
| 8 men at 4*s.* per day for 6 days | 9. | 12. | 0 |
| 3 boys at 1*s.* 6*d.* | 1. | 7. | 0 |
| 5 horses at 3*s.* | 4. | 10. | 0 |
| Engine and driver at £ 1 per day for 6 days | 6. | 0. | 0 |
| Silage Cutter at 15*s.* per day for 6 days | 4. | 10. | 0 |
| Coal | 2. | 0. | 0 |
| Beer | 2. | 18. | 0 |
| £ | 30. | 17. | 0 |

13 acres filled the silo to the top, and the *cost of filling per acre* *acre* = £ 30 17*s.* 0*d.* ÷ 13 = £ 2. 7. 6

*Total cost of silage per acre.*

| | £ | *s.* | *d.* |
|---|---|---|---|
| To grow | 4. | 10. | 3 |
| To cut | | 11. | 0 |
| To fill | 2. | 7. | 6 |
| Interest and depreciation of silo at 10 per cent. | 1. | 3. | 0 |
| £ | 8. | 11. | 9 |

*Ration given to dairy cows from 1st October to 31st December 1915.*

| | |
|---|---|
| 60 lb. Silage | 3. 66 *d.* |
| 24 lb. Turnips | 1. 28 *d.* |
| 1-6 lb. Concentrates (maize gluten at £ 10 per ton) | 1.71 *d.* |
| | 6. 65 *d.* |

This ration given to 17 Red Poll cows, produced during the first three months 32,254 lb. of milk or an average of 2 gal. per day, at a cost of 3.32 *d.*

for food per gal. This low cost was attained in an advanced period of lactation during a period of comparatively low daily production, and it is probably due to the high feeding value of the food forming the *base* of the ration and the small amount of concentrates.

The analysis of the silage gave the following results :

| | |
|---|---|
| Moisture | 61.31 |
| Albuminoids | 4.75 |
| Indigestible Fibre | 11.25 |
| Ash (Mineral matter) | 3.28 |
| Volatile Acid (acetic) | 0.45 |
| Non-volatile Acid (lactic) | 0.78 |
| Digestible Fibre, Chlorophyll, etc. | 18.18 |
| | 100.00 |

Yearling store cattle were successfuly wintered on 40 lb. per head per day of silage with only water in addition, and beef cattle did well when fed similarly to the milking cows. On the basis of these results the writer believes that the silo, besides furnishing a large bulk of valuable food at a low cost, offers the following advantages :

1) The certainty of an abundant supply of forage.

2) Complete suppression of weeds.

3) The forage is put into the silo in June and July, when the land is generally dry and the days are long.

4) There is no risk of loss from frost as with roots.

5) The soil is cleared early and then prepared for growing turnips to be folded off; heavier soils may be sown with mustard for green manure or to be fed off by sheep (" bastard fallow ").

6) It allows of a great saving of labour as compared with roots.

7) More stock can be kept on the farm than is possible with a crop of roots; consequently more dung is available.

It enables a high fertility to be maintained in the soil owing to phosphate manure with slag, the accumulation of nitrogen through pulse-growing, and a greater production of dung.

The milk obtained for the London market was always considered as of excellent quality and good flavour ; its fat content was, in January, from 3.90 to 3.95 % ; that of solids-not-fat from 8.81 to 8.86 %.

881 – **Experiments on the Digestibility of Various Little-used Cattle Foods.** — Morgan, Beger, Ohlmer, Michalowski, in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. 88, No. 3 and 4, pp. 243-290. Berlin, April 20, 1916.

1. — *Foods from the fruits of Phytelephas.* — These foods are sold in Germany under the form of a reddish and also a greyish product. According to the statement of the firm which supplied them, the red food originates from the nut of the Sudan, while the grey food comes from the fruits " guayaquil ", " Carthagena ", " esmeralda ", " tumaco " and " ohnedo ". The food was finely ground, but afterwards a coarser product in chips or shavings, as sold by the factories, was used. The reddish food, and also

the greyish, were tried both in flour and in chip form. The fruits used for the manufacture of these foods were dark brown in colour and of the size of a hen's egg. According to the botanical determination the fruits yielding the reddish food belong to the genus *Hyphaene* and those supplying the greyish food to the genus *Phytelephas*. The feeding trials (8 series) were made with 4 sheep and 2 pigs.

The pigs were first given 1200 gr. of hay of a known digestibility per day per head, then 500 gr. of hay were replaced by 500 gr. of the food which was being tested. The pigs, 3 months old, were first given 1 litre of full cream milk (goat's and sheeps) + 500 gr. of sliced potatoes, which latter were after wards replaced by the chips, so that finally the ration consisted of 1 litre of milk + 1200 gr. of chips.

The excrement of both species of animals was gathered from the 10th day of experiment onwards. The feeds employed were of the chemical composition indicated in Table I.

TABLE I. — *Percentage composition of the feeds tested.*

| Components | Reddish food | | Greyish food | |
|---|---|---|---|---|
| | Flour | Chips | Flour | Chips |
| Dry matter . . . . . | 91.50 % | 89.38 % | 91.38 % | 88.29 % |
| Ash. . . . . | 2.00 | 1.61 | 2.56 | 1.44 |
| Organic matter . . . | 89.50 | 87.77 | 88.82 | 86.85 |
| Crude protein . . . . | 5.19 (= 0.83 N) | 4.75 (= 0.76 N) | 5.44 (= 0.87 N) | 4.75 (= 0.76 N) |
| Pure protein . . . . | 5.19 (= 0.83 N) | 4.75 (= 0.76 N) | 5.38 (= 0.86 N) | 4.75 (= 0.76 N) |
| Fat . . . . . | 6.79 | 7.40 | 2.84 | 1.30 |
| Crude cellulose. . . . | 42.98 | 36.85 | 49.98 | 47.42 |
| Nitrogen-free extract. | 34.54 | 38.77 | 31.06 | 33.38 |

It will be seen that the protein content does not differ very much in the various groups, but the fat content in the reddish food considerably exceeds that in the greyish food. This larger fat content is, according to the evidence of the microscope, due to the presence of fat globules contained in the seed coat of the Sudan nut. The content of crude cellulose and nitrogen-free extract is more variable, but these variations are if anything due to errors of calculation, and are in reality smaller than shown by the analysis.

For determining the digestibility of the nutrient elements, the method based on the nitrogen insoluble in acid pepsin (1) was chiefly used; taking into account however that the laboratory method most in use is that based

(1) For this method see : *Die landwirtschaftlichen Versuchsstationen*, Vol. 61, p. 12 ; Vol. 85, pp. 1-104.

on the total nitrogen or that of STUTZER, the writers also ascertained the coefficients of digestibility according these tot wo methods.

Table II indicates the coefficients of digestibility.

TABLE II. — *Coefficients of digestibility of the foods tried.*

| Substances | Sheep | | | | | | Pigs | | |
|---|---|---|---|---|---|---|---|---|---|
| | Flour | | | Chips | | | Chips | | |
| | red | grey | average | red | grey | average | red | grey | average |
| | % | % | % | % | % | % | % | % | % |
| Organic matter | 86.7 | 78.1 | **82.4** | 75.7 | 74.7 | **75.2** | 74.9 | 77.6 | **76.3** |
| Crude protein | 59.2 | 60.6 | **59.9** | 26.3 | 60.5 | — | 46.7 | 57.1 | **51.9** |
| Pure protein | 59.2 | 60.2 | **59.7** | 26.3 | 60.5 | — | 46.7 | 57.1 | **51.9** |
| Fat | 90.6 | 74.7 | **82.7** | 93.4 | 32.3 | — | 88.5 | — | **88.5** |
| Crude cellulose | 98.2 | 91.6 | **94.9** | 86.0 | 77.7 | **81.9** | 85.5 | 84.4 | **85.0** |
| Nitrogen-free extract | 81.4 | 69.6 | **75.5** | 74.3 | 83.8 | **79.1** | 73.1 | 82.9 | **78.0** |

From these figures the following conclusions are drawn :

1) The digestibility of the organic matter and its principal constituents, crude cellulose and nitrogen-free extract, is very good, both in the sheep and the pig. Thefat was also well utilised, while the protein was less thoroughly digested.

2) The flour was digested better by the sheep than were the chips, but the difference is not sufficient to justify grinding. It is consequently more economical to use chips for sheep.

3) The pigs utilised the chips as fully as did the sheep.

4) There is only a slight difference in value between the reddish food and the greyish food.

5) Both the flour and the chips were readily eaten by the animals; they never caused any digestive troubles.

6) Crude cellulose particularly is highly digestible by the two species of animals. From this it may be concluded that it is not in a fibrous condition in the fruit, as FINGERLING has proved that fibre is not well utilised by pigs. This fact must be taken into account in forming an estimate of this food.

7) The food from the fruit of *Phytelephas* provides a good source of digestible carbohydrates. Nevertheless they must be regarded as adulterants when mixed with other concentrates (earth-nut meal, linseed meal, etc.). If sold pure and at a low price, the farmer may buy them.

II. — *Hay meal.* — Ordinary hay was finely ground and then administered to 2 sheep and 2 pigs in order to determine its coefficient of digestibility. Of the 2 sheep, one first received 1000 gr. of chopped hay, then 700 gr. of hay were replaced by the same quantity of hay meal; the other re-

ceived 1000 gr. of chopped hay all the time. In the 2nd experiment the rations were changed so that No. 2 also received hay meal.

To the pigs hay meal only was given, at the rate of 1000 gr. per head per day, with 1 litre of full cream milk.

The hay meal sifted through a Basic Slag sieve contained 60 % of fine matter. When examined with the microscope it was seen to consist chiefly of groups of cells with a little cell debris.

The digestibility was calculated from the total content of nitrogen insoluble in hydrochloric pepsin. It gave the following average starch value per 100 kg. of dried substance :

| | Sheep | | Pigs |
|---|---|---|---|
| | Chopped hay | Hay meal | Hay meal |
| Calculated from the total nitrogen . . . . | 25.5 | 26.4 | 17.6 |
| Calculated from the nitrogen insoluble in hydrochloric pepsin . . . . . | 27.4 | 28.2 | 21.7 |

It is evident from these figures that the difference between hay meal and chopped hay in the case of the sheep is so small that it may be entirely disregarded. It may hence be concluded that grinding hay does not increase its digestibility. The pigs utilised hay meal less effectively than the sheep, which is quite intelligible.

The starch value alone however does not furnish a sufficient basis for a fair valuation of hay meal. It must be borne in mind that, owing to the reduction of the work of mastication, the digested nutritive elements are better utilised in the case of hay meal than with ordinary chopped hay. Nevertheless, according to the writers, this advantage may be obtained merely by chopping the hay very small. Consequently the grinding of hay is superfluous.

III. — *Cladonia rangiferina*. — These lichens were gathered in Allgäu (Bavaria), thoroughly dried in the sun and afterwards roughly ground. They were first given to sheep and pigs to see whether they would take them. It was found that at the outset they were reluctantly eaten, but when mixed with good forage the animals consumed them regularly. The quantity absorbed, however, was small. To enable pigs to accept the lichens well the latter must be freed from the disagreeable tannic substances by treatment with a solution of potash.

For the digestion experiments only a small quantity of lichens remained at the disposal of the writers, so that they had to content themselves with making a parallel experiment with one sheep. The lichens were administered without having been previously treated with the solution of potash. The animal was first given 800 gr. of hay of known digestibility after which 400 gr. of hay were replaced by 400 gr. of lichens.

The dry lichens had the chemical composition shown in Table III.

TABLE III. — *Percentage composition of the dry lichens.*

| | | |
|---|---|---|
| Dry matter 91.36 % | Organic matter | 90.18 % |
| | Ash | 1.18 % |
| Crude protein = 0.72 % N. | | 4.50 |
| Pure protein = 0.72 % N. | | 4.06 |
| Fats | | 2.28 |
| Crude cellulose | | 41.01 |
| Nitrogen-free extract | | 42.39 |

The coefficients of digestibility were very low. On calculating them according to the total nitrogen, negative values were obtained. The starch value was likewise negative. All these analyses were confirmed by a microscopic examination of the excrement.

The writers conclude that lichens may be administered to sheep and cattle when there is a shortage of forage, but never to pigs or horses.

IV. — *Bone meal.* — This substance being at present often recommended in Germany as a food for ruminants and pigs, the writers carried out a digestion experiment with 2 sheep. The bone meal was administered to them in the proportion of 200 gr., with the addition of 800 gr. of hay. This ration was readily accepted.

The excrement was collected 10 and 11 days afterwards respectively.

The digestibility was very good for the protein, even reckoning the coefficients according to the total nitrogen. The fat is still more digestible.

Calculating the content of digestible elements according to the total nitrogen, the following figures are obtained :

| | |
|---|---|
| Organic matter | 40.6 % |
| Crude protein | 26.6 |
| Fat | 7.3 |

The content of crude protein calculated according to the nitrogen soluble in hydrochloric pepsin was 31.1 %

On calculating the starch value, by the aid of these figures, no result would be obtained which would allow of estimating the bone meal at its true value, as the result would relate to $^1/_3$ of fat and $^2/_3$ of protein. The protein is contained in it however chiefly in the form of collagen, a substance which is converted into glue during the process of digestion. The glue, in turn, is not a complete nitrogenous substance, as it lacks tryptophane, tyrosine and cystin. It is likewise unknown to what extent it is utilised by animals. Therefore as long as the value of glue and collagen as foods is unknown, it would be wrong to attribute an over-great food value to the organic matter of bone meal.

V. — *Blood meal as a food.* — The blood meal food corresponded in composition to that indicated by Kellner. It was given to 2 sheep in the quantity of 150 gr. along with 1200 gr. of hay.

The excrement was collected for 11 days.

The content of digestible elements in the blood meal according to the experiments, is shown by Table IV.

TABLE IV. — *Content of digestible elements in the blood meal.*

| | Calculated according to total nitrogen | Calculated according to the nitrogen insoluble in hydrochloric pepsin |
|---|---|---|
| | — | — |
| Crude protein | 65.5 % | 82.6 % |
| Pure protein | 63.2 | 82.2 |
| Organic matter | 65.4 | — |
| Starch value | 59.4 | 77.3 |

The protein consisting exclusively of pure protein and being highly digestible, the blood meal forms an excellent food which should be bought if not too dear.

In conclusion, the writers say that the determination of the coefficients of digestibility according to the total nitrogen should be abandoned as it often leads to errors. The method based on nitrogen insoluble in hydrochloric pepsin should be adopted, or if this is found too complex, STUTZER's method should be employed.

882 - **Nutritive Value and Digestibility of Wood; Feeding Experiments in Germany.** — HABERLANDT G., in *Forstwissenschaftliches Centralblatt*, 38th Year, No. 6, pp. 275-279. Berlin, 1916.

With the support of Messrs. ZUNTZ and VON DER HEIDE of the Physiological Institute of the Superior School of Agriculture in Berlin, and that of the Prussian Ministry of Agriculture, a digestibility experiment in a respiration chamber was carried out with a sheep for the purpose of determining the nutritive value and digestibility of birch wood. The trees were felled at the end of March, and the trunks, which were 10 to 15 cm. thick, were converted into very fine chips by a paper mill. The microscopical examination of these chips showed that the wood was very finely divided, so that the membranes of almost all the cells were destroyed. The water used in preparing the chips had removed almost the whole of the cell contents, in consequence of which fact the experiment allowed of determining more particularly the digestibility and nutritive value of the cellular membranes.

The composition of the air-dried wood was as follows :

| | |
|---|---|
| Water | 4.56 % |
| Dry matter | 95.44 |
| Ash | 0.46 |
| Organic matter | 94.98 |
| Crude protein | 0.67 |
| Crude fat | 0.45 |
| Crude cellulose | 32.30 |
| Nitrogen-free extract | 61.56 |

The daily ration consisted of : 450 gr. of wood, 30 gr. of wheat gluten, 100 gr. of molasses, 75 gr. of starch, 5 gr. carbonate of lime, and 100 cc. of a saline solution. After a preparatory period of 17 days the period of experiment

proper began, lasting 6 days. It yielded the following coefficients of digestibility for the wood:

| | |
|---|---|
| Organic matter | 50.09 % |
| Crude cellulose | 50.06 |
| Nitrogen free extract | 55.58 |
| Calories | 48.61 |

The digestibility was therefore excellent as regards the non-nitrogenous substances, the crude cellulose and the nitrogen-free extract. For the crude cellulose it is not below that of poor quality hay, and for the nitrogen-free extract it is 55.58 %

To arrive at the true nutritive value of the chips, allowance must also be made for the greater work of mastication and the loss of elements resulting from fermentation. On deducting the loss of elements, etc., from the above values, there results per 100 gr. of wood fed to the animals, 84.9 calories capable of conversion into animal substance and work. Given that 1 gr, of fat equals 9.5 calories, there are obtained in all from the 84.9 calories 8.94 gr. of fat. This figure is equal to a starch value of 35.8, which in turn corresponds to that of good meadow hay (36.2 according to KELLNER).

A microscopic examination of the excrement showed that it was not only the substances of the lignified cellular membranes easiest of decomposition (hemicellulose and pentosan) which were dissolved but even whole membranes, and that a good result is only obtained if the wood is cut up very fine and its cells are thoroughly torn. Non-observance of these two conditions was the principal cause of the failure of the previous experiments with sawdust.

Prof. RUBNER repeated these experiments on a dog, using the same wood. He obtained almost the same results. The dog, along with the wood ration, also received meat, the digestibility of which was not diminished. The experiments carried out on the dog lead the writer to the conclusion that man is also capable of digesting finely ground birch wood, and he thinks that from 10 to 15 % of rye or meal wheat should be replaced by wood meal in bread manufacture.

883 - **Experiments with Dogs in connection with the Mendelian Laws of Heredity.** — WELLMANN, O., in *Természettudományi Közlöny* (Bulletin of Natural Science), Vol. XLVIII, No. 9-10, pp. 315-320. Budapest, May 15, 1916. BREEDING

After first carrying out crossing experiments on mice, fowls and rabbits, the Author in 1909 crossed a black and tan basset with a spotted fox terrier bitch. The experiments which were continued for 5 years, at the Royal Superior Veterinary College of Budapest, sought to determine the inheritance of the colour and shape of the body of the male basset and the fox terrier bitch. The first cross produced 5 individuals of black and tan colour with white spots on the chest and legs, the stature in all cases recalling that of the sire. This fact seems to follow the law of Mendel in the sense that the black and tan colour and the shape of the body of the basset were dominant over the coloured spots and the normal stature of the fox terrier bitch.

*Results of black and tan basset cross with fox terrier bitch.*

| Number of matings | Progeny | | | | | Shape of body of fully grown dogs | | | | Died | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number | Sex | | Colour | | black and tan | | spotted | | black and tan | spotted |
| | | female | male | black and tan | spotted | basset | fox-terrier | basset | fox-terrier | | |
| 2 . . . . . | 6 | 3 | 3 | 5 | 1 | 4 | — | 1 | — | 1 | — |
| 3 . . . . . | 5 | 3 | 2 | 2 | 3 | 1 | — | 1 | 1 | 1 | 1 |
| 4 . . . . . | 5 | 2 | 3 | 4 | 1 | 3 | 1 | 1 | — | — | — |
| 5 . . . . . | 5 | 1 | 4 | 4 | 1 | — | — | — | — | 4 | 1 |
| 6 . . . . . | 11 | 8 | 3 | 8 | 3 | *4 | 2 | 1 | 1 | 2 | 1 |
| Totals . . . | 32 | 17 | 15 | 23 | 9 | 12 | 3 | 4 | 2 | 8 | 3 |
| Numerical ratio anticipated by theory . . . . . | | | | 24 : 8 | | 11.81 : 3.94 | | 3.94 : 1.31 | | | |

* very short-legged.

The question is next discussed: What will be the result of intermating the above progeny. If, to avoid confusion, only one character at a time is considered (monohybrid cross), the 1st generation should, according to Mendel's theory, beget black and tan individuals and spotted individuals, and individuals with basset stature and with fox terrier stature respectively; all this in the ratio 3 : 1. In the case of the dihybrid cross, the conditions are more complicated, because the different characters are formed into combinations. The writer draws up a table of gametic formulae, in which he collects the 16 theoretical combinations of the determining characters, According ot this table there would be formed in the 2nd generation in addition to the 2 parent types, 2 biotypes : the spotted basset and the black and tan fox terrier. The ratio of the 4 biotypes (differing externally) would be such that among the 16 dogs there would be 9 black and tan bassets, 3 spotted bassets, 3 black and tan fox terriers and 1 spotted fox terrier; each biotype would correspond to a homozygous individual.

While demonstrating theoretically what was to be expected from the 2nd filial generation, the writer reports the further course of these experiments: the animals resulting from the 1st filial generation were mated with each other 5 times, and produced 32 individuals: 23 black and tan and 9 fox colour. This result proves that the inheritance of the black and tan colour of the basset and the spotted colour of the fox terrier follows the Mendelian rule, and that the black and tan is always dominant, while the spotted character is recessive. Thus the ratio of the 5 matings (23:9) agrees with the ratio anticipated by theory (24 : 8).

Of the 32 puppies 11 died, and the remaining 21 grew up well. Of 21 fully grown dogs there were 16 with basset body (one of them very short-

legged) and 5 with fox terrier body. These results therefore prove that in addition to the basset-shaped dogs there were also in the 2nd generation dogs of normal stature giving practically the ratio which agrees with the theoretical calculation (15.75 : 5.25).

On examining the animals resulting from the 1st filial generation from the dihybrid point of view, experiment proves that the different characteristic features underwent combinations which, in addition to the parent types, produced 2 new biotypes : the spotted basset and the black and tan fox terrier. The appended Table shows the results obtained from the matings.

It will be seen from the Table that, of 21 dogs of the 2nd filial generation, there were :

| | |
|---|---|
| 12 black and tan bassets | 3 black and tan fox terriers |
| 4 spotted bassets | 2 spotted fox terriers |

In conclusion, the Mendelian ratios have for the most part been substantiated : whether the results be considered separately or taken in the aggregate, it is found that the resulting ratios are very close to those calculated by theory.

It is thought that on the basis of these experiments in crossing, dog breeders may build up a theory of hereditary transmission of certain characters peculiar to different breeds of dogs.

884 – **Relation between the Quantity of Milk formed and that obtained in Milking.** — ZWART S. G., in *Zeitschrift für Fleisch- und Milchhygiene*, 26th Year, No. 15, pp. 231-234 ; No. 16, pp. 246-250. Berlin, May 1 and 15, 1916. CATTLE

Agricultural literature contains abundant data in reference to milk and the milk-secreting organs, but few particulars as to the relation between the quantity of milk formed and that obtained in milking. Some experiments were carried out in connection with these questions, the principal results of which are set out in the present work.

According to NUESCH the secretion of milk may be divided into 2 phases ; rest period and milking. The rest period is the interval between two milkings ; the milking represents the phase during which secretion is promoted by mechanical and physical stimulation, and a distinction is made between preparation and execution of the milking. The first phase depends on the chemical factors of the blood which form the milk, while the second phase depends entirely on nervous influences.

The data relating to the quantity of milk formed during the period of rest diverge greatly. Some contend that the greater portion of the milk is formed during the rest period, while others maintain that it is chiefly formed during milking.

As a result of these experiments the Author is unable to confirm the first opinion as being correct. The arguments put forward by the partisans of the second theory, according to which the quantity of milk drawn from the udder exceeds the latter itself in volume, are also controverted. It was possible repeatedly to inject into the udder the quantity of milk pre-

viously drawn from it. In some cases it was even possible to inject twice the quantity of milk previously drawn from the udder.

It was also sought to determine by exact measurements the quantity of milk formed in the udder. Before milking, *i. e.* at the end of the rest period, the udder contains a quantity of milk made of up two parts, *a* and *b*. The part *a* represents the quantity of milk present in the largest galactophorous ducts of the udder (1) and which can be extracted by means of a milking tube, while the part *b* is the quantity of milk contained in the finer ducts and influenced by still other factors (capillarity etc). Part *a* is obtained by putting the milking tube into the channel in the teat. Part *b* is extracted by the Author in the following way : first the milk contained in the main ducts is removed, then the cow is killed, and when the blood has been entirely withdrawn, the teat is removed : it is put into a tureen, cut into pieces and then gently pressed. For this purpose cows yielding from 6 to 12 litres per day were used. The quantity of milk obtained from the small galactophorous ducts varied from 250 to 700 cc. ; it averaged 500 cc.

The experiments showed that the milking tube gave a quantity of milk almost equal to that obtained by remilking the cows after this operation. The quantity of milk formed during the rest period is equal to that found in the main ducts plus the contents of the small ducts *before* the preparation for milking. This latter quantity, as said above, averages 500 cc. From this however there must be deducted the quantity of the milk remaining in the udder from the last milking but one : it is always less than 500 cc. The quantity of milk formed during the milking equals the milk obtained by milking after removing the milking tube plus the milk left in the small ducts *after* milking (less than 500 cc.). Although the ratio between these two quantities of milk varies according to the individual and the excitability of the mammary glands, it may be said that the quantities formed during the period of rest and even during milking are equal in normal cows in good condition of lactation.

This rule is not confirmed when the second phase has been produced by stimulations other than those of the milker's hand. In those cases a larger quantity is obtained from the small ducts. This fact suggests that this stimulation, which leads to a downward movement of the milk, is not sufficient in the second phase to get out all the milk which the udder is capable of holding. In order to secure the whole of the milk the teat must be constantly stimulated.

This fact is of immense importance in connection with the use of milking machines. With mechanical milking, the mechanical stimulation is still greater than with hand milking, but even then milk always remains behind in the small ducts. This stagnation of the milk is injurious and hinders the formation of the fluid.

In the following chapter particulars are given of observations on fatten-

(1) The Author means by "largest galactophorous ducts" those ducts the contents of which are influenced by the same forces as the milk in the ducts communicating directly with the main duct. (*Ed.*).

ed cows and cow yielding an abnormal milk. It was found that the average quantity of milk obtainable from the udder by milking, after removal of the milk contained in the main ducts was not equal to that previously obtained with the milking tube ; the milk which had formed during milking represented 50 % at most of that obtained beforehand with the tube. From the low pressure of the milk in the udder observed after preparing to milk a cow which was developing mastitis, and from the observations of veterinary surgeons to the effect that some diseases of the udder are manifested by a reduction of the yield of good milk several days beforehand, the conclusion is drawn that somewhat abnormal glands are quite well able to form the milk of the first phase, but are inadequate to produce the milk of the second phase with sufficient rapidity. If the milk does not go down, or if it takes some time to descend, or if it descends in a smaller quantity than usual, it may be concluded that the cow is contracting mastitis, unless the reduction of the milk yield is due to nervous influences.

To illustrate the mode of formation of milk, the Author represented by curves the quantities of milk obtained by fractional milking of several cows. He was thus able to show that towards the end of milking more milk is drawn than is formed, so that after some time it is not possible to draw any more milk from the udder ; the cow is then completely milked.

Experiments were also conducted with a view to determining the quantity of milk contained in the main duct and in the teat canal. In this case also the data contained in the literature of the subject diverged. It was formerly generally believed that the main duct always contains a large quantity of milk, but latterly the statement sometimes appears that the main duct and canal of the teat do not contain milk during the period of rest. The writer was able to ascertain, in the case of about 100 cows, that all normal teats contained milk in their duct, and that the most swollen teats contained the smallest quantity of milk.

The fact that during the period of rest the milk does not pass out of the teat is due to the veins which swell and shut off the exit. Therefore milking is only possible when the blood has been expelled from the veins by specific excitation.

The teat canal never contains milk during the period of rest.

885 - **Effect of Water in the Ration on the Composition of Milk.** — Turner W. E., Shaw R. H., Norton R. P., and Wright P. A. — *Journal of Agricultural Research*, Vol. VI, No. 4, pp. 167-178. Washington, D. C., April 24, 1916.

Experiments conducted at Brownsville, Tex., by the Dairy Division of the Bureau of Animal Industry, U. S. Department of Agriculture indicate that the feeding of prickly-pear (*Opuntia* spp.) lowers the percentages of fat in milk. In comparison with other feeds, prickly-pear contains a large amount of water and mineral matter. It was thought by the writers that one or both of these constituents might be responsible for the reduction in fat percentage; consequently experiments were conducted to determine the influence of the water; work on the mineral matter is in progress. The literature dealing with the effects of watery feeds or water in the ration upon the quantity of milk produced is reported to con-

tain much contradictory evidence. The difficulty of eliminating all factors except the watery character of the ration is believed to be largely responsible for the conflicting nature of the statements.

The experimental work to determine the effect of water upon the composition of milk was conducted at the Dairy Division farm, Beltsville, Md., and included three different lactation periods. The four following methods for supplying rations of widely different water content were tried: *a*) a full allowance of drinking water as compared with a limited supply, the ration being alike in both cases ; *b*) a heavy ration of turnips as compared with one of dry forage ; *c*) wet beet pulp as compared with dry beet pulp ; *d*) green crimson clover (*Trifolium incarnatum* L.) as compared with the cured hay. Eight cows were used in the experiments conducted by the first method, four in the second, two in the third, and four in the fourth.

In every case except when the crimson clover was fed the amount of water drunk by the different animals as well as the difference in the water content of the forages under comparison, was determined.

With all except one cow in the wet versus dry beet-pulp group, the amount of water in the dry ration did not exceed 75 per cent. of that supplied by the wet ration, and with some cows that were given a limited allowance of water the dry ration contained less than 60 per cent. of the water content of the full-allowance ration. One cow in the wet versus dry beet-pulp group received, when the dry ration was fed, 88 per cent. of the water content of the wet ration.

In the green versus cured crimson-clover group, the former contained 71.23 per cent. water and the latter 8.33 per cent. The daily ration of green clover varied from 40 to 50 pounds per head, and of the cured hay from 16 to 22 pounds per head.

Certain individual cows at times produced milk having an abnormal fat content. This effect was apparently independent of the ration, as it occurred not only with the high water-content ration but with the dry as well. A study of the data obtained in the four series shows that the watery character of the ration has no effect upon the fat content of the milk. There was even less variation in the other milk constituents than in the fat. This indicates that rations of varying water content have no effect upon the composition of milk.

13 references bearing on the subject are quoted.

886 – **The Value of Maize Silage, Fed in Big Rations, in the Feeding Economy of Cattle.** — Allison H. O., in *The Breeder's Gazette*, Vol. LXIX, p. 1068. Chicago, May 18, 1916.

The agricultural test farm of Colombia (University of Missouri) recently sold on the Chicago market 5 lots each comprising 6 head of butcher's cattle fattened with different quantities of concentrates (maize, linseed and cotton seed cakes), ensilaged maize forage, and lucerne hay *ad lib.*

The following results bring out clearly the value of ensilaged maize in the feeding economy of fattening oxen, according to the prices per bushel quoted on the market for the foods used : maize, 70 cents ; maize silage, $ 4.50 ; cotton seed meal, $ 37 ; linseed oil meal $ 37 ; lucerne hay $ 14

per ton. The maize silage came from a crop which would probably have yielded about 60 bushels of grain per acre and in which the growth of straw was considerable.

The cattle were choice Herefords, bought in the market of Kansas City in such a way as to ensure the greatest possible uniformity, and cost $ 7.64 per cwt. delivered at the farm. After fattening in winter for a period of 133 days, they showed the following increase of weight :

| | Lot I | Lot II | Lot III | Lot IV | Lot V |
|---|---|---|---|---|---|
| Average initial weight per head, lbs. . . . . | 925 | 923 | 938 | 926 | 912 |
| Average final weight per head, lbs. . . . . | 1286.94 | 1249.44 | 1199.77 | 1243.05 | 1206.66 |
| Average increase per day per head, lbs . . . | 2.721 | 2.454 | 1.968 | 2.383 | 2.140 |

consuming per day per head the following average quantities of food (in lbs) :

| | Lot I | Lot II | Lot III | Lot IV | Lot V |
|---|---|---|---|---|---|
| Maize . . . . . | 15.597 | 15.242 | — | — | 15.274 |
| Cotton seed meal . . . | 2.600 | — | 5.055 | — | — |
| Linseed oil meal . . . . | — | 2.540 | — | 5.055 | — |
| Maize silage (ad lib) . . | 17.468 | 16.466 | 36.222 | 37.620 | 16.263 |
| Lucerne hay (ad lib) . . | 3.687 | 2.267 | 3.001 | 4.027 | 3.897 |

The economic result of fattening, according to the market prices of the above foods, was as follows :

| | Lot I | Lot II | Lot III | Lot IV | Lot V |
|---|---|---|---|---|---|
| | $ | $ | $ | $ | $ |
| Cost of increased weight, per 100 lbs. . . . . | 10.42 | 10.58 | 10.15 | 8.57 | 10.88 |
| Selling price in Chicago | 9.60 | 9.75 | 9.65 | 9.65 | 9.75 |
| Average net profit, per head. . . . . | 6.77 | 9.32 | 9.87 | 14.56 | 10.53 |

The highest profit coincides with the minimum use of concentrates and a maximum consumption of ensilaged maize and lucerne hay, while the maximum daily increase coincides with a minimum of profit due to a large consumption of concentrates.

887 – **Scale of Points adopted by the "American Jersey Cattle Club"** — *Missouri State Board of Agriculture Monthly Bulletin*, Vol. XIII, No. 11, pp. 56-57 ; Columbia Mo. November 1915.

The following scale of points has been adopted by the American Jersey Cattle Club for scoring for Jersey Bulls and Cows :

## *Score of Jersey Bull.*

| | Points |
|---|---|
| *Head*, 10: | — |
| A — Broad, medium length; face dished; narrow between horns; horns medium in size and incurving | 5 |
| B — Muzzle broad, nostrils open, eyes full and bold; whole appearance vigorous and masculine without any indecision | 5 |
| *Neck*, 7: | |
| Medium length, with full crest at maturity; clean at throat | 7 |
| *Body*, 57. | |
| A — Shoulders full and strong, good distance through from point to point, with well-defined withers; chest deep and full between and just behind the forelegs | 15 |
| B — Barrel long, of good depth and breadth, with strong rounded, well-sprung ribs | 15 |
| C — Back straight and strong | 5 |
| D — Rump of good length and proportion to size of body, and level from hip bones to rump bones | 7 |
| E — Loins broad and strong, hip rounded, and of medium width compared with female | 7 |
| F — Thighs rather flat, well cut behind high arched flank | 3 |
| G — Legs proportionate to size and of fine quality, well apart, with good feet and not to weave or cross in walking | 5 |
| *Rudimentary Teats*, 2: | |
| Well placed | 2 |
| *Hide*, 2: | |
| Loose and mellow | 2 |
| *Tail* 2: | |
| Thin, long, reaching the hock, with good switch, not coarse or high at setting-on | 2 |
| *Size*, 5: | |
| Mature bulls, 1200 to 1500 pounds | 5 |
| *General Appearance*, 15: | |
| Thoroughly masculine in character, with a harmonious blending of the parts to each other; thoroughly robust, and such an animal as in a herd of wild cattle would likely become master of the herd by the law of natural selection and survival of the fittest | 15 |
| | 100 |

## *Score of Jersey Cow.*

| | |
|---|---|
| *Head*, 7: | |
| A — Medium size, lean; face dished; broad between eyes; horns medium size, incurving | 3 |
| B — Eyes full and placid; ears medium size, fine carried alert; muzzle broad, with wide open nostrils and muscular lips; jaw strong | 4 |
| *Neck*, 4: | |
| Thin, rather long, with clean throat, neatly joined to head and shoulders | 4 |
| *Body*, 37: | |
| A — Shoulders light, good distance through from point to point, but thin at withers; chest deep and full between and just back of forelegs | 5 |
| B — Ribs amply sprung and wide apart, giving wedge shape, with deep, large abdomen, firmly held up, with strong muscular development | 10 |
| C — Back straight and strong with prominent spinal processes; loins broad and strong | 5 |
| D — Rump long to tail-setting, and level from hip bones to rump bones | 6 |
| E — Hip-bones high and wide apart | 3 |
| F — Thighs flat and wide apart giving ample room for udder | 3 |
| G — Legs proportionate to size and of fine quality, well apart, with good feet and not to weave or cross in walking | 2 |
| H — Hide loose and mellow | 2 |
| I — Tail thin, long with good switch not coarse at setting-on | 1 |

*Mammary Development.*

*Udder*, 26 :

A — Large size, flexible and not fleshy . . . . . 6
B — Broad, level or spherical, not deeply cut between teats . . . . . 4
C — Fore udder full and well rounded, running well forward at front teats . . . . 10
D — Rear udder well rounded and well out and up behind . . . . . 6

*Teats*, 8 :

Of good and uniform length and size, regularly and squarely placed . . . . . 8

*Milk-Veins*, 4 :

Large, long, tortuous and elastic, entering large and numerous orifices . . . . . 4

*Size*, 4 :

Mature cows 800 to 1 000 pounds. . . . . 4

*General Appearance*, 10 :

A symmetrical balancing of all the parts, and a proportion of parts to each other depending on size of animal, with the general appearance of a high-class animal, with capacity for food and productiveness at pail . . . . . 10

100

888 – **Progress of Guernsey Cattle in the United States according to Particulars of the "American Guernsey Cattle Club".** — CADWELL W. H., in *Hoard's Dairyman*, Vol. LI, No. 18, p. 742. Fort Atkinson, Wisc., May 26, 1916.

On examining the work carried out during the last working year of the American Guernsey Cattle Club, ended 29th April 1916, one fully realises the progress accomplished in the development of this dairy breed in the United States, and above all the continuous increase in the average production as it appears from the "*Advanced Register*".

The register of bulls contains 37 862 head, and that of cows 63 954 head, making a total of 101 816.

Five years ago there were only 44 286 animals registered, which shows that during the last five-year period, the Herd Register exhibited an increase of 130 %. As the importation of thoroughbred Guernseys since 1840, according to the best sources of information, was only 466 bulls and 7 121 cows, it follows that the importations were only 7.5 % of the number of these animals at present alive ; this proves how prolific the breed is in the United States.

There were issued 4 198 certificates of registration of Guernsey cows in the Advanced Register ; 949 of these cows were registered during the last working year which makes an increase of 90 % as compared with the preceding year.

The average production of 4 719 records tested is at present 8805.91 lbs. of milk and 439.15 lbs. of fat. During the last year this average rose by 132.18 lbs. for milk and 5.24 lbs. for fat.

There are at present under test 1 173 cows, belonging to 270 breeders in 28 States ; 70 % of these breeders, or 190, have 854 of these cows (72 %) under the 2 days' test. There are also 18 superior State Schools of Agriculture which keep Advanced Registers for their own dairy herds.

10 Guernsey cows entered in the Advanced Register have a four-years average of 11915.7 lbs. of milk and 630.93 lbs. of fat.

The Club numbers 530 members, of whom 64 joined last year.

Its capital is about $216 251 63 and its expenditure last year $83 272 07.

PIGS

889 – **Pig Breeding and Intensive Maize and Soya Pasturage, in the United States.** — BEAVERS J. C. (Purdue University), in *The Breeder's Gazette*, Vol. LXIX, No. 22, pp. 1160-1161. Chicago, June 1, 1916.

The importance of combining soya with maize in connection with pig breeding is clearly brought out by the facts collected by this writer and due partly to actual practical work and partly to the breeding tests carried out for Purdue University.

From the food trials it has been found that 8.8 lbs. of maize plus 2.2 lbs. of soya are equivalent, for pig fattening, to 15.2 lbs. of maize alone. By combining soya with maize, an intensive pasturage for pigs is obtained, by which the maximum of unit yields may be secured. The following are, in brief, the increases of weight obtained per acre during the experiments and those yielded in practice, together with the rules for combining the two feeds:

*Carroll Co.* (*Indiana*). — A plot of 5 ½ acres put down to maize combined with soya was reserved for pasturing 99 pigs averaging 108 lbs. weight each, for a period of 27 days and gave a total increase of live weight of 5 288 lbs. or 2 lbs. each per day. The presumable crop of maize would have been about 70 to 75 bushels per acre, and that of soya 12 to 14 bushels.

*Clarke Co.* — A plot of 2-3 acre in 15 days produced an increase in weight of 1210 lbs., or 526 lbs. per acre, in 34 pigs, plus a further increase of 74 lbs. obtained with some sows by utilising the pasturage residues. In all a live weight increase of 600 pounds per acre resulted. The anticipated crop would have been about 45 bushels per acre.

In the trials of combining soya with maize the average yield obtained was as much as 61 bushels total grain per acre, and the yield of maize was almost always higher on the parts where it was combined with soya than on those where it was not. In two cases, with non-inoculated soya seeds, there was a yield markedly unfavourable to the combination, owing to the fact that the soya, being almost completely devoid of root nodules, deprived the maize of a good proportion of the soil nitrogen.

For ensilage the combination of soya with maize is also preferable to maize alone. The many trials carried out yielded, on the average, an increase of 2521 lbs. silage per acre over the yield of maize grown alone ; in wet years, an average increase of 3600 lbs. per acre in favour of the combination. Moreover, the resulting forage is richer in protein substances than maize forage alone.

Putting pigs out to pasture forms in turn the best mode of turning the crop to account and many experiments, borne out by practice, have proved that the successive growing for several years of maize together with soya on the same plot, with the object of feeding the standing crop to pigs, does not noticeably reduce the fertility of the soil, because, in addition to

the manuring, a large quantity of organic substance is left on the soil, which is incorporated in the latter by ploughing and promotes fertility.

The combination of soya with maize demands the choice of varieties of soya which mature at the same time as maize, principally in those cases where, to reduce expenses, sowing is done simultaneously. In the United States, in the maize zone, between the 38th and the 41st degree of latitude, the Hollybrook variety possesses this quality.

Three methods of sowing soya are at present in use : 1) some farmers provide the maize sower with special boxes for soya, in order to sow them together ; 2) others mix the soya with dry sifted soil, and distribute the seed with the manure spreader of the maize sower ; they usually put down 12 lbs. per acre of soya seed and 65 lbs. of soil when the manure spreader is adjusted to 75 lbs. per acre; 3) others sow the soya separately after maize, going over the furrow twice, but this method is more expensive. The quantity of 12 lbs. per acre represents approximately 3 or to 4 soybeans to each row.

890 – **On the Value of Lime in Relation to Silkworm Nutrition.** — HATANO IWARICHI., in *Bulletin de l'Association séricole du Japon*, Year II, No. 4, pp. 1-4. Tokio, March 1, 1916. SERICULTURE

For his experiments, the writer used silkworms of the Koishimaru race having but one generation a year. He reared them on the ordinary method up to the end of the 4th moult. At the time of the 5th moult he formed 4 groups of 500 worms each, which he fed with leaves treated : 1) with a solution of calcium bicarbonate ; 2) with a solution of calcium chloride ; 3) with a solution of calcium acetate; the 4th group was fed with untreated leaves (control). All the solutions were of 5 % strength. The solution was spread on the leaves in a very fine spray, to the amount of 4 centilitres per 100 *mommé* (375 gr.) of leaves. When dried the leaves were given to the worms.

On the whole, the worms fed on leaves treated with lime salts grew much more than those of the control group, as is shown by the following weights (in grams) :

| Groups | 100 adult worms | 100 live cocoons | 100 silk cocoons | 100 chrysalids | 100 cast skins |
|---|---|---|---|---|---|
| 1st. . . . . | 211.35 gr. | 166.53 gr. | 23.25 gr. | 142.42 gr. | 0.87 gr. |
| 2nd. . . . . | 217.90 | 167.23 | 23.89 | 142.44 | 0.88 |
| 3rd . . . . . | 217.94 | 169.11 | 23.47 | 144.76 | 0.88 |
| 4th (control) . . . | 196.81 | 157.34 | 22.18 | 134.38 | 0.79 |

The weight of the dried bodies of 100 mature worms, with the intestine entirely emptied, in the case of the groups fed with lime salts exceeded by 4 to 8 grams that of the dried matter of the control group. The weight of the dried matter of 100 live cocoons exceeded that of the control group by 3 to 4 gr., made up as follows :

| | |
|---|---|
| Silk cocoons . . . . . | 1 to 1.5 gr. |
| Chrysalids . . . . . | 2 to 2.5 |
| Cast skins . . . . . | 0.07 |

The percentage of dry matter was also 8 to 15% higher than that of the control group in the mature worms, and 5 to 7 % in the dry cocoons and the silk cocoons.

The weight of calcium contained in the groups under experiment exceeded that of the control group in all cases, both in the mature worms and in the silk cocoons ; in the larvae the excess was 25.14 % in the calcium acetate group, while it was lower than this, namely 3.07 and 11.93 % respectively, in the calcium bicarbonate and chloride groups.

The investigations will be continued in order to ascertain which lime salt is most favourable to the growth of the worms and in what degree of concentration.

It is finally pointed out that according to an analysis by NAGAKA MUNEYOSHI the ash of the ripe Japanese mulberry leaf contains :

| | | | |
|---|---|---|---|
| Phosphoric acid | 12.02 % | Sulphuric acid | 4.65 % |
| Potash | 31.47 | Chlorine | 0.06 |
| Soda | 3.16 | Silicic acid | 1.45 |
| Lime | 33.15 | Oxide of iron | 1.59 |
| Magnesia | 12.48 | | |

Lime is therefore present in a proportion almost three times that of magnesia ; this excludes the possibility of its beneficent action on the larvae being due to an antagonism to the action of magnesia, similar to that observed in plants.

891 – **Study of Sericulture in Madagascar.** — in *Bulletin économique de la colonie de Madagascar et dépendances*, Year 15, No. 1, pp. 1-17, Tananarivo, 1st Half Year 1915.

Before the French occupation, the silk used by the natives was obtained exclusively from *Borocera madagascariensis*, occurring very widely in the central and western parts of the island and on a considerable number of plants. It sometimes becomes a positive pest in the mimosa plantations. It is still regularly reared on the " tapia " (*Upaca clusiacea*) which exist in more or less dense forests on the lateritic hills. The " tsitoavina " (*Dodonea madagascariensis*) and the " ambrevade " (*Cajanus indicus*) are also reared. In the regions of Majunga and Maintirano, *Borocera* lives wild in the *Rhizophora* forests of the coast and the natives gather cocoons at certain periods of the year.

There are other wild native larvae belonging to certain silk-bearing species of *Bombyx ;* namely *B. Radama* and *B. Diego*. They are found in almost all the forests of the eastern slope and the North. The caterpillars have the peculiar feature that they enclose their cocoon in a large envelope which they weave in common and which is sometimes 1 metre in length. Since the French occupation, especially since 1900, the silk industry in the island has been based on the rearing of *Bombyx mori*.

After dealing with the cultivation of the mulberry tree 1) and the technical conditions of silkworm breeding 2), some information is given on the

(1) See *B.* March 1913, No. 267.
(2) See *B.* June 1914, No. 555. (*Ed.*)

production of silkworm eggs, cocoons and silk, and finally an account of government encouragement afforded to sericulture and the future in prospect for this industry in the island.

The Nanisana station annually prepares from 300 to 350 thousand layings of moths, which are distributed free to European and native rearers.

In the Centre of Madagascar the cocoon has retained the classical form of the good French cocoon. As regards their size above all and the quality of the threads, the Madagascar cocoons are comparable, according to competent authorities, with the cocoons of the Cevennes. The experiments carried out at the Public Silk Conditioning Establishment in Lyons and by several spinners in the South of France and the North of Italy plainly show that the silkworm races of Madagascar when subject to continuous and methodical selection can furnish cocoons at least as rich in silk as those of the European breeds.

The raw silk is comparable in all points with the good raw silk of Piedmont and the Cevennes.

The local government, in addition to free distribution of the eggs produced by the station of Nanisana, has distributed more than 200 000 rooted mulberry plants. The " cultivation agents " attached to the public departments demonstrate to those concerned the conditions of silkworm rearing. Finally, premiums are distributed for cocoons at the rate of 3*d*. 2*d*. and 1 $^1/_2$ *d*. per kg. (2.2 lbs.) according to quality.

With regard to spinning, the decree of the 21st July 1910 allows an annual premium for a period of 10 years from the 1st January 1911, of 400 francs per degummer working with more than 3 ends ; another premium of 400 francs is granted for additional degummers at the rate of one additional degummer to every three working with more than 3 and less than 9 ends, and at the rate of one accessory degummer per two degummers working with more than five ends.

892 – **Researches on the Digestibility of Different Foods used for Rearing Young Fish.** — WOHLGEMUTH RICHARD, in *Allgemeine Fischerei-Zeitung*, Year 1915, No. 18, pp. 271-275. Munich, 1915. FISH.

At the Bavarian fish-breeding Station of Wielenbach, the Author carried out feeding experiments in order to determine the digestibility of different foods for fry. For this purpose he employed rainbow trout fry 8 weeks old and of normal development. In order to produce like conditions the food under study was always given in the morning, 12 to 14 hours after the last meal, so that the fry, under the stimulus of hunger, regularly ate their ration. The natural food was generally eaten withtin a few minutes ; the ration was always abundant, and the part uneaten was afterwards removed. After half an hour at least the fish were taken out and studied from the point of view of food digestion. The term « digestion completed » means that the stomach is left quite empty or contains only indigestible remains. Each time at least 10 fish together were taken.

The following were the foods studied ;

1) *Spleen* : It was carefully freed from skin, then forced through a filter to remove all the tougher portions. Before giving it to the fry it

was cut up into small pieces. Two hours afterwards the fish showed a well filled stomach, but no signs of digestion as yet : 4 hours afterwards, signs of digestion were evident ; 5 hours afterwards the contents of the stomach were less in quantity ; 6 hours afterwards 2 fish had their stomachs empty, and 7 hours afterwards digestion was completed in all the fish. The conclusion drawn is that the spleen is digested 6 to 7 hours after feeding.

2) *Liver* : Same preparation as for the spleen. Its digestibility is very different. Some fish were found with their stomachs empty as little as 6 hours afterwards, while in others digestion was only completed 8 hours afterwards. Generally it may be said that digestion is terminated within 7 to 8 hours.

3) *Fish flesh* : The flesh of freshwater fish was given either separately or together with spleen, liver and shrimps to older fry. The fish used for preparing the food were put into hot water and left there from 1 to 5 minutes according to size ; they were then pressed in moulds after removing the skin and bone from the biggest.

Three hours after the meal, the stomach of the fry was still quite full ; 4 hours afterwards digestion was begun,and 6 hours afterwards all the fish had their stomachs empty. The conclusion drawn is that the flesh of fish is completely digested 5 to 6 hours after the meal.

4) *Shrimps* : Shrimps also were only given during the period previous to the stocking of the pond with fry. The shrimps were first left in boiling water for half to three quarters of an hour, then pressed in moulds. Only fry which have reached a certain age readily eat shrimps alone ; for younger fry they must be mixed with soft substances such as liver, spleen etc. At first 50 % of shrimps are mixed with 50 % of liver, etc. Then in proportion as the age of the fry increases the proportion of shrimps is increased, until finally shrimps alone are fed to them.

In the case of the fish receiving shrimps alone digestion was completed 5 to 6 hours after the meal.

(5) *Larvae of Culex pipiens* : These were eaten by the fry within a few minutes : 1 $^1/_2$ to 2 $^1/_2$ hours after the meal digestion was begun. The writer counted a maximum of 18 larvae in the stomach of one fish. Digestion was terminated 4 to 5 hours after the meal. An interesting fact is that the chitinous parts of the larvae remain in the stomach of the fish for a very long time, probably owing to derangements impeding the peristaltic movement of the stomach. The same fact is observed when *Daphnidae* are given.

(6) *Daphnidae* : The larvae of *Daphnia magna* and *Daphnia pulex* were given. They were immediately devoured by the fish, which ate about 20 per head per meal. The first signs of digestion were observed 2 $^1/_2$ hours after the meal, and digestion was completed 3 $^1/_2$ to 4 $^1/_2$ hours after the meal.

*Conclusions.* — Liver requires twice as long as shrimp for digestion. Liver and spleen require most time, the natural food (Culex, etc.) requires the least time. Fish-flesh and shrimps are intermediate between these two groups with regard to the period of digestion. The causes of the easy

digestion of the natural food are : (*a*) the large surface presented by the larvae as a whole, which enables the gastric juice to attack the food thoroughly ; (*b*) the loose consistency of the food in the stomach of the fish ; (*c*) the gastric juices of the larvae etc., which contribute to digestion in the stomach of the fish.

It follows from the above that the natural food is the best for the fry of Salmonids. To the youngest fry, spleen can also be given when the natural food is wanting. When the fry reach a certain age a ration may be given them consisting of spleen plus fish-flesh, or spleen plus shrimps, or again fish-flesh alone. The mixture fish-flesh plus shrimps also gave satisfaction with, somewhat older fry.

893 – **Fish Breeding in Switzerland in 1915.** — *Bulletin suisse de Pêche et Pisciculture* XVIIth year, No. 5, pp. 59-63. Neuchâtel, May 1916.

As during the preceding year (1), 212 establishments were carried on during the incubation period 1914-1915. 128 857 000 fry hatched out from 156 696 000 incubated eggs. Including 63 239 small fish of one summer or one year, 127 694 239 fry were put into public waters under federal supervision. The appended Table gives particulars of the fry resulting from the incubated eggs.

*Number of larvae hatched out.*

| | |
|---|---|
| A. — Native species. | |
| Salmon | 1 337 000 |
| Salmon trout, hybrid | 34 000 |
| Lake trout | 2 655 000 |
| River and stream trout | 9 168 000 |
| Char | 4 456 000 |
| Grayling | 2 632 000 |
| Coregonus | 97 244 000 |
| Pike | 10 706 000 |
| Perch | 130 000 |
| Carp | 205 000 |
| B. — Exotic species. | |
| Rainbow trout | 284 000 |
| American char | 6 000 |
| Total | 128 857 000 |

The Confederation paid to the cantons, for transmission to the fish breeders in question, a subsidy of nearly £ 1400 (nearly £ 1500 in 1914) for the

(1) See *B.* 1914, No. 1038. (*Ed.*)

incubation of the eggs and the transfer of the fry to public waters. The canton of Valais is not comprised in the above figures, as the establishments in that canton did not make any application with a view to obtaining a federal subsidy. No fish breeding was carried on during that year in the canton of Appenzell Rh. Int. The Swiss fisheries and fish breeding Society received a federal subsidy of about £ 120. Similarly to other riparian States, the Swiss Confederation made a grant of £ 12 to the International Union of Fishers of the Lake of Constance, for the expense of stocking that lake in 1915. In the same year Swiss fishermen took from that lake, including the lower lake, 331 573 lbs. of fish of a value of over £ 9800 (in 1914, 322443 lb of a value of over £ 9284).

The number of fishery guards in the service of the cantons was 161 during the year 1915, aided temporarily by 19 assistants. These agents received, by way of salary, attendance and travelling allowances, a total sum of £ 4363 (£ 4262 in 1914), of which the Confederation took upon itself £ 2182 (£ 2131 in 1914), or 50 % in accordance with the law. The cantons also expended £ 18 (£ 21 in 1914) for the destruction of animals injurious to fisheries, but the Confederation refunded about £ 15 (£ 9 in 1914).

A course of instruction was given in Lucerne from the 22nd to the 27th February for water bailiffs.

Fish ladders were established in the vicinity of various works (August-Wylen, Laufenbourg) along the Rhine, as well as near the hydraulic power stations of Perlen, in Reuss. Refuges for fish have, in accordance with the instructions of the Swiss Home Office, been built along the altered bed of the Wina, between Reinach and Gotenschwil, on account of the reclamation of the marshes there.

The federal legislation on fisheries has undergone no change. The regulations of the 2nd May 1913 on fishing in the boundary waters between Switzerland and Italy was slightly modified by decree of the 2nd July 191.5

VARIOUS

894 – **Cross between a Wild and a Domesticated Fur Rabbit in order to obtain a Good Fur.** — ZIMMERMANN R., in *Berliner Tierärztliche Wochenschrift*, Year, 32, No. 18, p. 213. Berlin, May 4, 1916.

For some years past experiments have been carried out in Germany by the writer with a view to obtaining a rabbit combining the following three qualities: (*a*) a fur superior to that of the common domesticated rabbit; (*b*) good meat; and (*c*) high resistance to disease. The results hitherto have been as follows.

1) By crossing a wild male (grey coat) with a female of the French silvered breed (black coat with a few white hairs) and a female of the German breed " Edelweiss " (Albino), the offspring were 10 in number, 4 males and 6 females. All the 10 offspring were grey in colour and their physical conformation was that of the wild sire, but they were bigger. Ther meat is lighter but clearly suggests the wild meat. The fur is more supple than that of the sire.

The writer still has 1 male and 2 females of this litter; the other animals were either sold to breeders or killed. These 3 individuals have retained the timidity characteristic of the wild rabbit.

2) A grey male obtained by crossing a wild male with a French silvered female was crossed with the German female " Edelweiss " ; the progeny numbered 4 : 2 black and 2 grey. Of these latter there are still 1 black and 1 grey individual, both having reached half the normal growth. The black rabbit already shows white hairs in the black coat, thus recalling the silvered granddam. These 2 subjects have supple fur, but they still possess the timid character of the wild rabbit.

3) The second litter from the above cross consists of 4 animals now aged 5 weeks, 3 of them being black and 1 grey.

4) On crossing a male rabbit with a female of the same litter originating from the cross wild male × French silvered female, a litter was recently obtained which has not yet been studied, but which meanwhile already discloses the interesting fact that the mating of the parents of this litter, who are brother and sister, is fertile.

895 – **Gum Lac and the Breeding of *Tachardia*.** — I. DUPORT L. L'Insecte à Stick-lac. II. HAUTEFEUILLE L. La gomme laque et son traitement industriel, in *Bulletin économique de l'Indochine*, Nos. 112 and 116, pp. 182-189 and 872-994. Hanoï-Haïphong, March-April and November-December 1915.

This study contains a summary of ten years of research and observations carried out by M. HAUTEFEUILLE. The stick-lac insect, *Tachardia lacca* R. Bld., known also under the names of *Carteria lacca* Sig. and *Coccus lacca* Kerr. is one of the rare useful cochineal insects ; it produces gum lac and also a red colouring substance termed lac dye by the English.

In India, where this product is very important, several species of *Tachardia* are probably known, or at any rate several varieties of *Tachardia lacca*, which explains the contradictions in the information supplied by different authors. DUPORT describes the insect, giving general information as to its life history, with a separate description of the female, the male, and the method of reproduction. He also enumerates the enemies of *Tachardia* and among others: ants, the larval forms of Noctuidae and Tineidae, and some Hymenoptera belonging to the family of Braconidae and Chalcididae.

HAUTEFEUILLE next studied gum lac and its industrial preparation. Gum lac should not be confused with lac of vegetable origin derived from *Rhus vernicifera* in Tonkin. Gum lac is a half-waxy, half-gummy secretion of an insect living in innumerable colonies on some plants in India. It has many important industrial uses, and the trade, as shown by the tables appended to the paper, attains considerable proportions. India exported on the average, during the 11 years 1903 to 1914, 17 736 tons per year of an approximate value of about £ 356 641 at a unit price of 11.68 *d.* per pound. Indo-China during the period 1906-1914, exported on the average 1 092 249 lbs. per year, for £ 24 190, at the average unit price of 5.67*d.* The range of the lac insect lies within a vast rectangle enclosing Tonkin and the northern tracts of British India. *The Dictionary of Economic Products of India* by G. WATT gives the list of the plant species on which the lac insect is able to live ; this list is reproduced by the writer with the addition of some further species reported by the Forestry Department of Assam. This

list comprises among others *Acacia arabica* and *A. catechu* and the genera *Albizzia, Butea, Ceratonia, Ficus, Erythrina, Tectona* and *Zizyphus.*

*Ricinus communis* is included in the list given by the Assam Forestry Department. The principal species, however, on which colonies of *Tachardia* are usually found are chiefly *Butea frondosa, Cajanus indicus, Ficus religiosa, Zizyphus jujuba* and finally *Schleichera trijuga* which supplies the best gum lac.

The writer reproduces the principal passages of a study by MAXWELL-LEFROY on the lac insect *Zizyphus jujuba.* This insect has two generations a year. The eggs hatch in June and the insects develop until the end of September-October, when oviposition takes place. This second generation completes its life cycle about the end of May. The trees require to be cut in time, as it is important that the insects should be inoculated into strong shoots with abundant sap, but the bark of which can be easily attacked by the rostrum of the insect. Inoculation is effected by taking a piece of gum lac in which the eggs are about to hatch ; this is placed between two plates of bamboo and tied to the shoot of the tree or shrub on which the rearing is carried out. The emergence of the insects soon takes place, and in proportion as they are hatched they range themselves round the parent or original gum lac, going up the branch on which they were placed. It is important that they should not be allowed to mount up too near to the end, where they would not find sufficient food. As soon as the insects have discovered a favourable point to insert their rostrum, they lose their legs in a first moult, and if they are females they become motionless until the end of their life-cycle. The males on the contrary, whether winged or wingless, leave their scale within a few weeks and mate, but die soon afterwards. The females, when once they have been fertilised, become gradually mature and then commence oviposition, which weakens them gradually until death ensues. The resin is formed between the time of fertilisation and that of oviposition ; during this time the female projects out of her resinous coating white waxy filaments which give the colony a white downy appearance denoting its good state of health. According to MAXWELL, the wild jujube tree is particularly adapted for this type of rearing ; a plant in good condition and well inoculated should yield about 22 lbs. of lac.

These insects usually have two generations in India. They are said nevertheless to have three generations in the province of Madras, Mysore and Burmah. MR. STEBBING, zoologist to the forestry department of India, advises the establishment of special plantations of the species on which the insect lives best, and he adds that the colonies ready to swarm should only be taken from trees of the species on which it is intended to settle the insect, or in any case the colonies should have lived on harder species than those on which it is proposed to settle them. The branches bearing the future swarm must be cut so that the larvae do not swarm during transport and the sap in the branches themselves does not dry up, which would cause the death of the females before the maturity of the eggs.

Comparative data are supplied with regard to the production in Indochina and India. The stick lac of India is more friable than that of

Indochina. Generally, Indian lac fetches better prices than Indo-chinese, although the latter is in turn well quoted on the market, and regarded for instance as superior to that of Siam. It is particularly appreciated owing to its purity and the absence of any resin.

For the production and collection of the lac, it is pointed out that the natives have always seemed astonished to hear of crops being obtained from the forest ; they assume that its production can only be obtained on plants specially cultivated for the purpose. Nevertheless, lac of Indian origin is often described as forest produce. No data are available to clear up this question. With regard to the cultivated plants, some of them are able to supply two crops per year for two or three consecutive years even, but generally a rest period of one year, or at least of one crop or two, is required.

The memorandum next supplies information with regard to the geographical range of *Tachardia* and the experiments carried on to extend its production. It is interesting to note that the most suitable spots for production should not be either too hot or too cold, the rainfall amounting to 29.25 inches per annum, humidity should not be wanting but must not be excessive ; dry and arid tracts must be rejected. The observations made in Indochina give from 1310 to 2130 feet as the limits of altitude. A temperate climate and places sheltered from the wind, but airy and hilly, seem the best.

The writer has collected the data supplied by the experiments made for spreading the insect in Indo-China and he describes the means employed in Indo-China and India for purifying lac. Summarising afterwards the results of his researches and excursions, he records that production in Indo-China is carried on in three regions only : those of Sonla, Song-Ma and Nam-Hon. He recalls the fact that the production of lac requires thorough aeration and the presence of a species of big light red ant, which according to the natives is to be credited with combating all other ants injurious to rearing, the latter being easily recognised as they are black and small. Finally, there is published a scheme of research intended to complete the geographical distribution of producing areas, to specify more clearly the nature and distribution of the most useful species, to study the different kinds of lac produced and the reasons why some lots are insoluble in alcohol, and to extend the cultivation of *Schleichera trijuga*, which is also useful owing to its edible kernel rich in oil, but which is above all recommended for the production of the lac known in trade as " Fine Orange ".

According to the writer the researches should also extend to the entomological study of *Tachardia*, the economic conditions of its rearing, the trade and exchange of eggs, the study of the ant regarded as useful and the conditions and requirements of the various markets.

Finally, the report comprises two plants representing the plant and appliances required for the refining of gum lac.

## FARM ENGINEERING

AGRICULTURAL MACHINERY AND IMPLEMENTS

896 – **Electric Tillage in the Province of Piacenza, Italy.** — *L'Italia Agricola*, 53rd Year. No. 3, pp. 120-121. Piacenza, March 15, 1916.

In the province of Piacenza, tillage by electricity supplied by cable has been carried on for about 3 years over enormous tracts of land, and the work thus executed in 1915 has proved that the problem of this tillage is on the way to being finally solved.

The machinery employed for this work by the BRIOSCHI Electrical Undertakings Company yielded satisfactory results everywhere, both in regard to the depth and the regularity of ploughing.

With 2 plough shares working a strip 26.5 inches wide to a depth of 13.8 inches at an average speed of 47.3 inches per second, the machine ploughs 10.76 sq. ft. per second, allowing for stoppages at the headlands, its normal output may amount to 7.41 acres per day of about 11 hours' work.

The winch is actuated by an 80 H. P. electric motor, the usual consumption being only 60 to 70 H. P. Being fed direct by the feed mains with 3600 volts, it can be placed at any point of the system. The feed current is transmitted to it by a flexible cable coved with a metal tube, which follows the winch in its forward movement. Owing to special terminals the current can be switched on or switched off at any moment when the mains are under load. The staff required does not exceed 3 men : one at the winch one at the plough, and one at the transmission carriage by which the reciprocating movement of the plough is produced, these three parts of the machine being kept in alignment so as to facilitate supervision and checking of the work.

897 – **Mechanical Tillage Experiments with Tractors at York, England, in 1915.** — GILCHRIST J., in *The University of Leeds and The Yorkshire Council for Agricultural Education*, No. 100, *Report on Demonstrations with Motor Tractors at York*, 1915, 24 pp., 4 tables + 8 plates. Leeds, 1916.

In agreement with the University of Leeds and the Yorkshire Agricultural Education Committee, the Yorkshire Agricultural Society had demonstrations of tractors and cultivation machines carried out in November 1915, near York. The data combined in the appended Table are taken from the detailed Report of these trials.

*Principal Results of Trials.*

| Motor tried | Maker | Power | Price | Uses | Fuel burnt | Area ploughed in 10 hours |
|---|---|---|---|---|---|---|
| Fowler motor plough. | J. FOWLER & Co., Leeds. | 10 HP | £ 159 | Will draw any cultivator. Can drive small stationary machines but not big threshers. Will not do rope haulage. | Petrol 12.5 gallons Can also use benzol and may be adapted for using paraffin. | 2.49 acres |
| Universal Tractor. 20 BHP. | SAUNDERSON & MILLS, Bedford. | 20 BHP | £ 327 | Will draw any cultivation machine; 3 reapers or 2 reapers and binders. Will drive stationary machines including large threshers. Will haul up to 5 tons on road. | Paraffin with 9 % of petrol, 8.3 gallons | 9 acres |
| Mogul Tractor 16. HP | INTERNATIONAL HARVESTER Co., London. | 16 HP | £ 274 | Will draw 2 reapers and binders. Will drive any stationary machine. Will haul up to 5 $^1/_2$ tons on road. | Paraffin 8.7 gallons * | 6 acres |
| Mogul Tractor 25. HP | Do. | 25 HP | £ 435 | Will execute all work including road haulage. | Petrol 5 gallons | 10 acres |
| Overtime Tractor. . | THE OVERTIME FARM TRACTOR Co. Ltd., London. | 24 HP | £ 233 | Will execute all work except ordinary road haulage. | Paraffin 5 gallons | 6.24 to 6 ac. according to the compactness of the soil |
| Sandusky Tractor 40/45 HP. | MILLS & SONS, London | 38 BHP | £ 582 | Will execute all heavy work, including road haulage. | Benzine ** | ** |
| Daimler Tractor . . | THE DAIMLER Co. Ltd., London. | 40 HP | £ 605 | Will execute all work, including road haulage. | Petrol 6.2 gallons | 8.5 acres |
| Mann Steam Tractor 22B HP | MANN'S PATENT STEAM CART AND WAGON Co. Ltd., Leeds. | 22 HP | £ 469 | Do. | Coal 2.5 cwt | 8.5 acres |

* Estimated quantity. — ** It was not possible to obtain these data during the experiments. The makers indicate a consumption of 2 gallons of petrol per acre.

898 - **Portable "Vasino" Cereal Drier.** — TARCHETTI A., in *Il Giornale di Risicoltura*, VIth Year, No. 7, pp. 119-124. 2 fig. Vercelli, April 15, 1916.

This drier, mounted on wheels, and designed by MESSRS. VASINO BROTHERS, at Ponzana (province of Novara, Italy), is on the *tipping plane* system, (like the types CATTANEO GEMINARDI & GUIDETTI ALBERTINI) BOLTRI, etc.). The appended figure shows the arrangement of its essential parts.

The case shaped like a parallelopiped, is divided into superposed compartments by a series of horizontal aprons (9) made up of strips of metal gauze or perforated tin plate, each of which turns on its horizontal axis, tipping and thus emptying the grain to be dried on the apron immediately beneath. Each shaft has an end which is prolonged outside the case and is fitted with a fork lever through which an endless metal cable passes; this cable can run horizontally in a parallel direction to each of the successive aprons, while rising rigzag from one floor to the other, owing to 2 opposite sets of grooved pulleys which are fitted alternately at one end of each floor; it is fitted with an excentric cam which is unable to pass through the fork and therefore compels each lever in succession to shift and to tip the corresponding strip of the apron ; then, as soon as the fork is released from the the excentric, it is returned to its position by a spring or counterweight fitted to each lever.

Of course the tipping movement of the strips making up the apron, produced in this way by the cable movement, is intermittent. It is made to recur at lesser or greater intervals (generally from 10 to 20 minutes) according to the degree of dryness required in the grain. The stopping and starting of the cable are controlled by a special device placed in front of the machine at *O* and *E*.

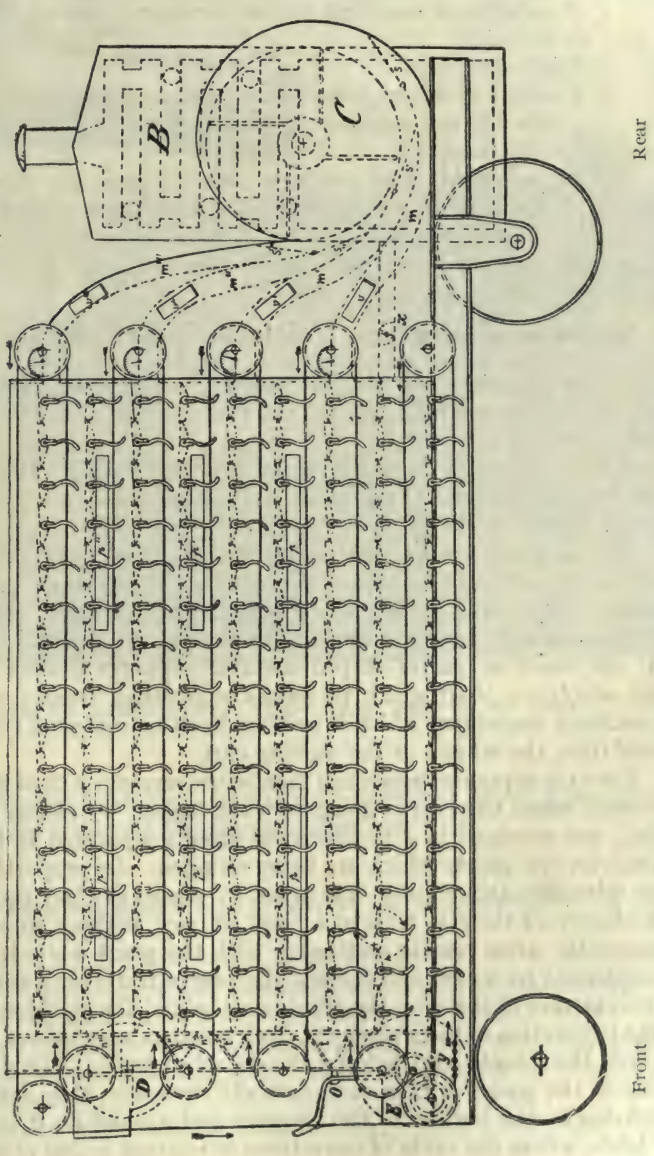
The hot air used for drying is supplied by the stove *B* placed behind the car; it is drawn up from below by the aid of 2 large fans *C* fitted to the side walls of the stove, and is injected into the case through a set of nozzles *m* - *m'* - *m''* - *m'''*, the flow being regulated by the dampers *s* - *s'* - *s''* - *s'''*.

This injection of hot air does not take place into each compartment but only in one out of two, so that between each pair of compartments thus ventilated there is one which the hot air is compelled to enter after passing through the layers of grain on the upper and lower aprons, afterwards emerging from the case through the front apertures *n* - *n'* - *n''* - *n'''* or the side apertures *p* - *p'* - *p''* - *p'''*, provided in the walls.

Two suction arrangements *D* accelerate the air current at will. On the other hand the pipe *x*, fitted with a damper, brings the lower compartment into communication with the air inlet from the stove. By operating the damper *x* and the dampers *t* - *t'* - *t''* provided in the pipe of the suction devices, therefore, the hot air more or less saturated with moisture emerging from the case can be utilised wholly or in part.

The grain to be dried is inserted in the apparatus every 10 or 20 minutes, and spread in a uniform layer of 3 to 4 $^{3}/_{4}$ inches thickness on the upper apron, from which it descends, passing successively through the others to the lower apron, and on reaching the latter is deprived of its moisture.

From this lower apron the dry grain is discharged automatically onto the ground, after being gradually recooled by means of the cold air drawn in from without through the suction fan *D* or the tube *x*.




*Vasino Grain Drier - Longitudinal Section*

The advantages possessed by the Vasino drier may be summed up as follows:

1) Machine occupying very little floor space, the portable type with 9 aprons examined by the writer weighed. 1102 lbs. and measured : length 18 ft., width 8 1/4 ft., height 10 ft.

2) Simplicity and reliability of the apron tipping mechanism.

3) Great facility in altering the path and temperature of the air used for drying, according to the kind of grain to be dried.

4) Possibility of carrying out very energetic drying by always passing dry air through.

5) High efficiency.

6) Limited fuel and power consumption (hardly more than 1 HP).

7) Little labour required : 1 workman to feed the machine and 1 to look after the discharge.

The output of this drier of course depends upon the degree of dryness required. The makers assume that in order to dry paddy which is not over-wet it will suffice to pass it through the machine twice for 15 minutes at a time, and under these circumstances they estimate the continuous daily output (12 hours) at about 177.12 cwt. of dry paddy.

899 - **Machine for Gathering Cotton Fruits without Injury to the Plant.** — *Scientific American*, Vol. 114, No. 22, pp. 551 and 564, 3 fig. New York, May 27, 1916.

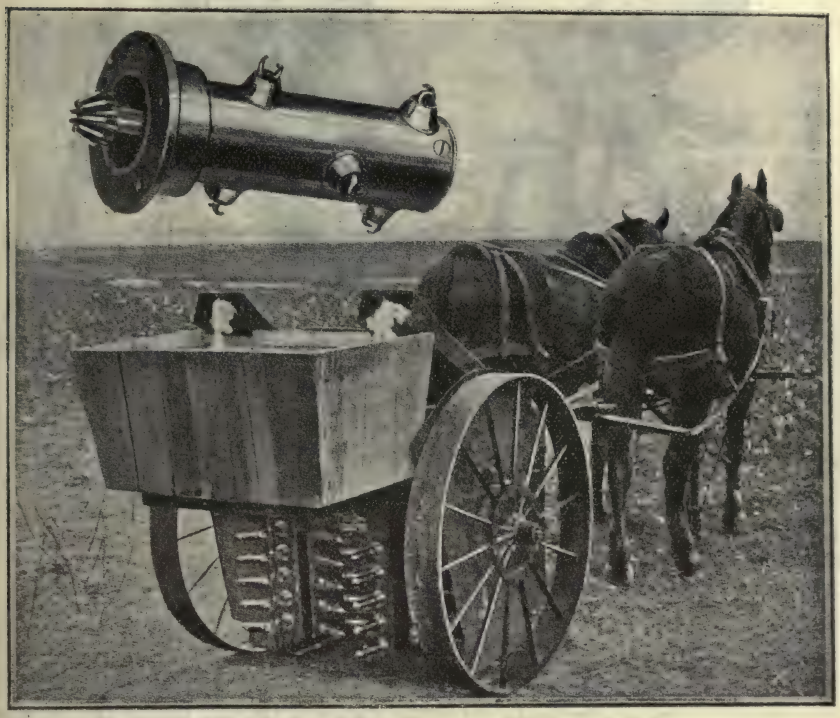
A light machine (990 lbs.) in the shape of a 2 wheeled cart with broad tires, the mechanism for gathering the ripe fruits of the cotton plant being located between the wheels.

It is drawn by 2 horses straight over the rows, so that the working parts detach the fruits of the plant and deliver them into a wooden box at the rear of the cart.

The cropping mechanism comprises 100 fixed arms (one of which is shown separately at the top of the annexed illustration), each carrying a number of revolving points, which gather the ripe bolls. These arms, directed backwards and thus working in an opposite direction to that of the cart, are fixed on gutter-shaped metallic supports (hollow laths), within which revolves a shaft which, by means of gearings, transmits to the points the rotatory movement which it receives itself by means of an endless chain driven from the wheels of the moving cart.

The arm supports, which can themselves revolve on their shaft and move backward when the cart is going forward (again by means of the endless chain), are arranged in 2 symmetrical groups separated in the middle by a space for the plants which are being cropped. In proportion as the machine advances above a row, the arms, by means of their revolving points, pick almost all the *ripe* bolls of a plant at once, without injuring the plant (because the arms remain stationary with the plant while the entire vehicle continues to move) and leaving the unripe fruits for a subsequent crop. On completion of this crop the plant is left behind the machine and the arms, owing to rotation of their supports, drop down on each side of the apparatus towards the wheels, still holding the detached bolls. The direction of rotation of the points is then automatically reversed ; they release the bolls, which fall to the bottom of the elevator and are fed by it into the box at the back, where the cycle of operations in relation to *one* plant terminates.

This cycle begins afresh for the following plant, first by bending down the arms towards the free space in the middle, enabling them to gather the bolls



Machine for gathering cotton fruits without injury to the plants.

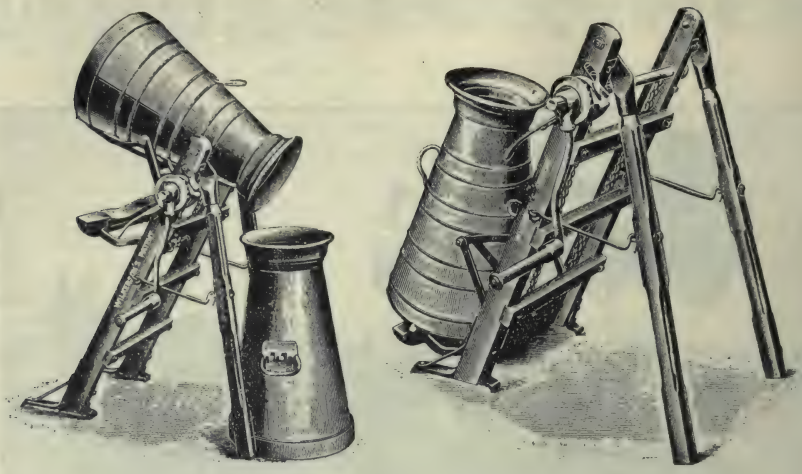
and continuing and finishing afterwards as described above, the same process being repeated for all the plants in one row.

900 – **Milk Can Emptying Machine.** — *The Implement and Machinery Review*, Vol. 42, No. 495, p. 312. London, July 1, 1916.

By the aid of this contrivance, built by the firm of S. WILKERSON, Bassingbourne (Cambridgeshire, England), and which is used to empty the milk from one can into another or from a can into a tank, a boy can do as much work as 2 labourers without any fatigue as he only requires to turn the crank ; in addition the losses of milk which usually occur in emptying by hand are avoided.

The apparatus may be built for any height ; it has folding legs to facil-

itate transport, and can also be easily converted into an ordinary sack hoist.



WILKERSON Milk can emptying machine.

## 901 – Review of Patents.

*Tillage machines and implements.*

| | | |
|---|---|---|
| Austria | 71 833. | Cultivator. |
| British India | 2 089. | Improved plough attachment. |
| Germany | 283 708. | Harrow consisting of two parts connected by a joint. |
| | 283 863. | Ditching machine. |
| | 284 228. | Arrangement for ploughing with portable engine. |
| | 284 414. | Motor plough with beam moving in a vertical plane. |
| | 284 494. | Cultivator with twisted spring teeth and obliquely placed disks. |
| | 284 495. | Device for preventing fouling of the bars bearing the shares in gang ploughs. |
| | 284 496. | Soil divider for furrowing ploughs. |
| | 284 553. | Ditching plough. |
| | 284 712. | Hoe with adjustable blade. |
| | 284 713. | Plough with couch grass lifter. |
| | 284 963. | Balance plough. |
| | 285 007. | Machine for cutting irrigation ditches in meadows. |
| | 285 086. | Motor plough with frame that can be raised or lowered. |
| | 285 166. | Guiding apparatus for agricultural machines, especially for motor ploughs. |
| | 285 412. | Shovel wheel for motor ploughs the shovels of which have a digging and throwing motion. |
| | 285 618. | Motor plough with automatic starter. |
| | 285 720. | Machine for bringing sub-soil to the surface. |
| | 285 749. | Plough cable with electrical conductor core. |
| | 285 843. | Brake for cable ploughs with electrical drive for return. |
| Italy | 151 960. | Improvements in common ploughs drawn by animals. |

Spain 61 892. Plough.
Switzerland 72 705. Turn-wrest plough with adjustable draught device.
United Kingdom 1 581. Means for propelling ploughs, cultivators etc.
United States 1 181 106 — 1 181 394 — 1 183 828. Harrows.
1 181 287. Wing harrow.
1 181 345 — 1 183 138. Ploughs.
1 181 353 — 1 182 340 — 1 183 482. Cultivators.
1 181 480. Attachment for ploughs.
1 182 154. Multiple section stalk cutter.
1 182 304. Corn harrow.
1 182 826. Combined hoe and seed planter.
1 182 910. Coupling for a tractor and plough.
1 183 465. Traction plough.
1 183 686. Reversible side hill plough.
1 183 723. Cotton cultivator and chopper.
1 183 783. Lister plough.

*Manure distributors.*

Austria 71 580. Manure distributor.
Germany 284 029. Fertilizer distributor especially for cyanamide.
284 364. Manure spreading device.
284 449. Fertilizer distributor in which artificials are blown out from a series of nozzles close to the ground.
285 087. Machine for comminuting and spreading farmyard manure.
United Kingdom 2 893. Manure distributor.

*Drills and sowing machines.*

283 680. Device for ploughs of potato planters.
284 030. Device for adjusting the openings of seed holes in agitator seeders
284 384. Drill feeder with adjustable bottom.
284 385. Sowing machine with distributing wheels in the seed hopper.
285 679. Potato planter.
286 251. Elevator for potato planter.
Switzerland 72 706. Sowing machine.
United States 1 181 436. Corn planter attachment.
1 181 539 — 1 181 930. Seed drill.
1 183 346. Corn planter.

*Reapers, mowers and other harvesting machines.*

Austria 71 840. Knife for mowers.
Germany 285 062. Device for lifting the knife of mowers into a vertical position.
285 167. Horse-rake in which the rake can be lifted by gearing on the wheels.
285 238. Knife for mowers.
285 292. Horse-rake.
285 825. Swath rake convertible into a tedder.
United Kingdom 2 585. Hay-cocking machine.
2 667. Apparatus for stacking hay, straw, etc.
3 081. Hay making machine.
United States 1 182 119. Hay unloading apparatus.
1 182 846. Grain shocker.

1 182 899. Mowing machine.
1 183 065. Two row corn-cutter.
1 183 092. Traction binder or header.
1 183 768. Corn cutting machine.

*Machines for lifting root crops.*

71 479. Potato lifting machine.
Denmark. 21 166. Potato lifting machine.
21 218. Device for potato lifting machine.
Germany 283 866. Beet topping machine with one knife.
283 867 — 284 242. Riddling and delivery of potatoes in potato harvesting machines.
284 229. Potato fork with interconnected tines.
284 651. Throw wheel with collapsible spring tines for potato harvesters.
285 510. Tine wheel for discharge of stems and leaves from potato harvesters.
285 511. Beet harvester with forks, which pull the roots almost vertically out of the soil.
286 140. Forks for lifting potatoes and the like.
286 141. Potato harvester with throw wheel revolving in the same direction as the machine proceeds and delivering the potatoes sideways.
286 158. Potato harvester with a seat behind the shares for a person to pick out the stems and leaves.
286 230. Potato harvester with share, oscillating screen and riddle drum.
United States 1 181 768. Potato harvester.
1 182 149. Beet pulling and topping machine.

*Threshing and winnowing machines.*

Austria 71 834. Threshing machine in which the sheaves are fed sideways.
France 479 762. Threshing machine for cereals and forage seeds.
Germany 284 031. Wheat cleaner and grader with shaking endless grading band.
284 033. Straw shaker, the inclination of which can be adjusted, for thrashing machines.
284 388. Winnowing machine with automatic regulation of the current of air.
284 389. Drum for winnowing machine.
285 413. Device for cleaning cereals, especially wheat.
Italy 151 400. Automatic sheaf feeder for threshing machines.
Spain 61 995. Apparatus for continuous feeding of threshing machines from the ground.
United States 1 181 360 — 1 181 373. Grain saving device for threshing machines.
1 183 156. Separator or grader.

*Machines and implements for the preparation and storage of grain, fodder, etc.*

Germany 284 008. Wire guide with clamp for straw presses and the like.
284 386. Device for hoisting the bundles of straw turned out by straw binder.
285 206. Machine for separating hairy weed seeds.
286 159. Potato sorting machine.
United States 1 181 497. Hay press.

1 182 144. Potato separator.
1 182 436. Wagon hay stacker.
1 182 718. Self feeding and self tying mechanism for hay presses.

*Dairying machines and implements.*

Austria
71 338. Separator for milk and the like.
71 339. Combined milk sieve and cooler.

Germany
283 840. Supply-can for milk separators.
284 243. Holder for the tails of cows, while milking.
284 365. Churn revolving round a vertical axis.
284 366. Centrifugal friction-coupling for milk separators.
284 367. Device for the automatic closing of the suction pipe from the teat cups in milking machines.
284 640. Milk separator with plates.
285 009. Valve for interrupting the suction in the teat-cups of a milking machine when the flow of milk ceases.
285 010. Elastic sides for teat-cups with varying thickness along their length and with reinforced bottom provided with an opening.
285 168. Butter machine with rotating churn and an obliquely mounted beater.

*Other agricultural machines and implements.*

British India
2 253. Improvement in and relating to manufacture of paper making pulp from esparto and the like.

Germany
283 748. Vermin trap with hoop for net.
283 865. Tractor for ploughs with steering wheel in front of driving wheel
283 904. Apparatus for feeding sucking-pigs.
284 095. Trap for rats, mice and other animals.
284 130. Beet slicer.
284 342. Cable drive for the road wheels of agricultural machines.
284 450 — 285 063. Chaff cutter.
284 493. Agricultural tractor with two driving wheels each driven by an electric motor and with a generator of electricity driven by an internal combustion machine or the like.
284 497. Device for killing injurious animals.
284 590. Device on agricultural machines for carrying the reins of the draught animals.
284 711. Agricultural motor.
284 951. Wild mustard weeder.
284 984. Crank driven machine for felling trees and cutting timber by means of a wire heated by friction.
285 008. Cable with electrical conductor core.
285 166. Steering device for agricultural machines especially motor ploughs.
285 263. Ventilating device for clamps.
285 264. Chaff cutter with endless chain feeder.
285 329. Agricultural motor that can be used as motor car.
285 471. Three-wheeled agricultural motor.
285 512. Apparatus for sharpening scythes by pressure and traction.
285 513. Machine for making ribbon shaped fly-catchers.
285 783. Device for watering trees.
285 807. Watering can.

285 821. Sieve with alternate conical depressions on each side.
285 890. Horse feeding apparatus.
286 003. Automatic feeding apparatus especially for pigs.
286 035. Clockwork device to scare birds by shooting.
286 070. Device for controlling vermin, especially earth-fleas.

Spain . . . . . 61 992. Olive crusher.

United Kingdom 1 721. Machine for extracting essential oil from limes and oranges
1 844. Appliance for protecting growing strawberries.
2 117. Sugar cane mills.
2 955. Collapsible cloche for horticultural purposes.
2 971. Apparatus for cutting and slicing vegetables.

United States 1 181 255. Alfalfa mill.
1 182 104 — 1 182 883 — 1 183 123. Tractors.
1 183 381. Traction engine.
1 183 669. Caterpillar tractor.

FARM BUILDINGS.

902 – **New Method of Fireproofing Wood** (1). — *Engineering Record*, Vol. 72, No. 24, p. 717. New York, December 11, 1915.

This method of fireproofing shingles was tested in the Forests Products Laboratory at Madison (Wisconsin, United States). It is based on the formation of an insoluble salt, borate of zinc, which melts at a high temperature and covers the fibres of the wood with a protective coating.

The air-dried shingles are first impregnated with a watery solution of borax, then stove-dried until their percentage of moisture does not exceed 10 per cent. After this they are impregnated with a solution of zinc chloride, once more dried in the stove, and are then ready for use.

The two solutions must be applied under high pressure, which necessitates the use of strong plate reservoirs, pressure pumps, standardised recipients and other comparatively expensive contrivances. Consequently this process can hardly be used to advantage except where large quantities of wood are to be treated.

The experiments have shown that the shingles treated by this process and immersed in running water for two weeks had not lost their fire proof properties thanks to the insolubility of the zinc borate

When exposed to a fierce fire the shingles treated burn, it is true, but without flame, which is an important quality, because it prevents the fire spreading from one part of the roof to another by the falling sparks or burning brands.

903 – **Fencing-poles with Rot-proof Feet.** — PLUMLEY G. L., in *American Agriculturist*, Vol. 96, No. 22, p. 6. New York, November 27, 1915.

By the following comparatively inexpensive method, fencing poles may be provided with a rot-preventing cement foot.

Along each pole from 1 to 2 angle irons are fixed which project outward from the pole by an amount equal to the length of the foot to be fixed in the ground ; this free end is placed vertically in the middle of a varnished terra-cotta drain (or 2 superposed drains), after which the empty space is

(1) See *B.* 1914, No. 462. (*Ed.*)

filled with Portland cement mortar ; when setting is completed, the poles are ready to be fitted up.

Poles of this kind can last an indefinite time, especially if the precaution is taken to paint them afresh every year. When the wood begins to rot, it can easily be detached from the foot and replaced.

904 – **Device for protecting Sucking-Pigs.** — DESSAISAIX R., in *Journal d'Agriculture pratique*, 80th Year, 1916, No. 12, pp. 216-217, 2 fig. Paris, June 15, 1916.

Various arrangements have been contrived to prevent sows from overlaying their young when lying down along the wall of the sty. Among these contrivances the following, applied in various piggeries in Switzerland, may be pointed out : along the walls of the sty, a series of irons *f* are placed, at about 20 inches distance from each other. Fig. 2 is a detail view of one of

*Arrangement for protecting Sucking Pigs.*

Fig. 1

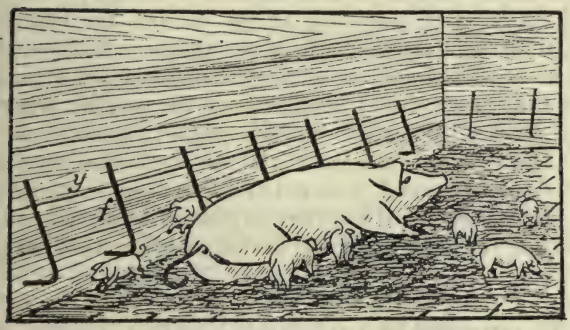
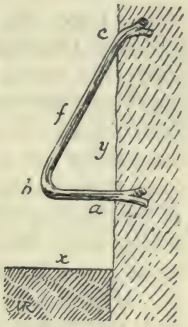



Fig. 2




these irons, *f* the lower limb *a* of which is at 6 or 7 inches above the ground *x* of the sty ; this height can be altered according to the size of the sow, the point *b* being always about level with the teats. The rounded projection *b* is about 6 or 7 inches in front of the wall *y* and the upper point *c* may be nearly 16 inches above the limit *a*. The round irons *f* 0.6 to 0.8 inches in diameter, have their ends run into the brick wall ; if the wall is made of wood they may end in a claw so as to fix them by means of screw rings.

The arrangement under examination provides the young pigs with a passage either below or above the limb *a*.

## RURAL ECONOMICS.

905 – **Discussion as to the Method of Effecting Valuations.** — ALBANI GIUSEPPE., in *Il Monitore Tecnico*, XXIInd Year, No. 7, pp. 97-100 ; No. 8, pp. 117-120. Milan, March 10 and 20, 1916.

An examination of the fundamental principles which prove the utility of the analytic method in valuation, and determine the limits of accuracy between which theories of valuation may be accepted in practice.

Valuation considers real estate as wealth in the strict sense of the word (static aspect) or as capital, that is to say, wealth tending to reproduce wealth (dynamic aspect).

Valuation can only estimate the value of real estate at a given economic moment, because the unit of measurement, currency, changes in value, *i. e.* in potentiality of exchange, in the course of time.

One of the practical fields for the application of the science of valuation is the market, where real estate wealth is exchanged for currency wealth which takes the name of price; but according to the writer, the field of action of the market has different limits from those of valuation, because all properties which cannot be alienated and for which a value but not a price might be fixed are outside the market limits. Moreover, on the market, where the exchange of real estate is actually carried out, the status of the contracting parties has a great influence upon the particular market value in this case, while valuation, which is impersonal, does not allow for these influences. In practice, a valuation is often required for the purpose of estimating the selling value, thus compelling the valuer to base his judgment on that likely to be given by the market.

Market and valuation only deal with real estate considered as capital, and can therefore only be estimated by capitalisation either directly or indirectly of the revenues and material advantages which it produces.

At any given moment, in each locality, the value of all the real estates furnishing equal revenues will be equal (provided of course that all forms of positive and negative revenue are calculated). In view of the difficulty of valuing immaterial revenues, it is customary in practice to divide the revenues of real estate into material and immaterial revenues ; the corresponding rate of interest is also divided into 2 parts, one being ascribed to the material and the other to the immaterial revenues. Then, only the material revenues are capitalised in proportion to their share of the rate of interest which, owing to this fact, will be greater or less than the current rate, according as the positive or negative revenues predominate in the immaterial revenues; the resulting capital value is considered as the value of the whole real estate.

To determine the value of real estate it is necessary to estimate : 1) the amount in currency of its material revenues and that of the share of immaterial revenues which can be valued; 2) the rate of interest according to which this amount is to be capitalised. According to the methods that can be employed in determining these data, a decision as to the value of the analytic method of valuation, can be made.

The writer divides valuations, according to their purposes, in 3 principal categories, in Table I :

TABLE I. — *Categories of Valuation.*

- Valuations having for their final object the determination of
  - Revenue
    - Valuations for purposes of taxation ;
    - » for usufruct or life interest.
  - capital as a source of
    - Temporary Revenue
      - Valuations for mortgage security ;
      - » for compensation for damage caused by hail, etc. ;
      - » of damage resulting from military action ;
      - » in respect of temporary occupation ;
      - » of indemnity for bad management of properties rented.
    - Perpetual Revenue
      - Valuations for expropriation ;
      - » of improvements or damage caused by neglect ;
      - » of servitudes ;
      - » for change of value due to the opening of new public roads or the establishment of new means of communication.
  - capital independent of revenue
    - Valuations of indemnity for fire, earthquake, etc. ;
    - Treasury valuations for ascertaining value for succession or death duties, etc. :
    - Valuations for guarantee of dowry, trust properties, etc. ;
    - Valuations for changes in value of lands due to regulations for their improvement.

According to the economic nature of the real properties to be valued (buildings, building and farm lands, quarries, mines, etc.), the categories of Table II are drawn up.

TABLE II. — *Categories of Valuations according to the economic nature of the property.*

- Real property yielding evenue
  - directly
    - material
      - in cash : real property let at a fair price payable in cash ;
      - in produce :
        - real property let at a fair price payable in kind ;
        - real property managed or worked by the owner
        - buildings to be demolished for utilisation of the building material ;
    - immaterial : buildings and lands required for social or public purposes for road construction, religious purposes etc. ; sterile fields, properties yelding no revenue and incapable of yielding any ;
    - mixed
      - with dynamic function : real properties with improvable revenue ;
      - with static function : houses serving for purposes of pleasure.
  - indirectly : buildings and lands needed for the exercise of an industry ; building lands.

The writer examines the categories contained in Table II and points out that none of them can escape the necessity of analysis in order to determine the capitalisable income it is capable of yielding ; he arrives at the same conclusions on considering the valuations according to the object they have in view. The difficulties of economic analyses are of 3 kinds, according to the amount of revenues which the real property can produce, the price by which its value may be expressed in currency, and finally the time to which these revenues and their valuations relate.

From an examination of these difficulties and the method which valuation suggests for overcoming them, the writer concludes that the valuation can only, quite conscientiously, draw up approximate judgments, and the valuer can only indicate the maximum and minimum limits within which are contained not only the value asked of him, but also all the values which each of the persons called upon to give their opinion may attribute to the real property in question. If he has to decide in favour of a single value, the valuer will within these limits look for the normal average value, the determination of which for one real property always gains by being the result rather of an analytic valuation than of a market valuation ; because, while the market value is made up of 2 parts which each contribute their personal tendencies to the exclusion of all others, the expert according to the rules of valuation divests himself of his own personality in order to assume a personality summing up the tendencies of the others.

Examining next the other methods of valuation termed *indirect, direct empirical, statistical* and *mixed methods*, the writer observes that they all take their rise more or less remotely from economic analysis, and with regard to the analytic method he draws the following conclusions :

In view of the fact that the value of real property depends on the total revenues obtained from it and the rate of interest at which they are capitalised, and that this value cannot be determined otherwise than by means of these two factors, it is absolutely necessary, after reviewing all the cases which occur in valuation, to conclude that each of these must be analysed in order to ascertain either the amount of the revenue or the rate of the material and immaterial revenues which can be derived from each real property and consequently the rate to be applied for capitalisation. As in these determinations there may be differences of valuation, the estimate must allow for extreme valuations; its conclusions must therefore usually be expressed within maxima and minima, between which the entire series of valuations of different persons may fluctuate, and it must, in order to reach these conclusions use the methods which the science of valuation shows to be sanctioned and accepted as accurate in practice. If the valuation is required to give a single precise value, it must select the latter within the scale lying between the two extreme values, either taking into account the particular conditions and the purposes of this special problem, or by calling to its aid all the subsidiary criteria which experience and practice may suggest, in order to find the standard of valuation which the majority of persons would apply in this particular case and for this particular object. In these cases the valuation must never be considered as containing an ab-

solute and unassailable judgment. Under these circumstances the valuation can test the accuracy of its judgments by comparing its own estimate with other similar valuations in like cases, but it must do this carefully, given the extreme difficulty of establishing a perfect comparison between different cases.

Valuation should not resort to other methods than the analytic except for rough estimates, and should always maintain some doubt as to the accuracy of the results if they are not corroborated by a thorough examination, the direct consequence of which is to lead to an analysis. If it be borne in mind that analysis is, and should always be, the means by which the results are obtained or checked in the course of time, it may be doubted whether there really exist any other methods of valuation than the analytic method.

906 – **Cost of Production of the Principal Cereals in European Russia.** — KOTELNIKOV V. in *Сельское Хозяйство и Лѣсоводство, журналъ Министерства Земледѣлія* (*Agriculture and Sylviculture*, review published by the Ministry of Agriculture). Vol. CCL, Year LXXVI, pp. 451-459. Petrograd, March 1915.

The section of Rural Economy and Agricultural Statistics of the Ministry of Agriculture recently published the results of an enquiry into the cost of production of the principal cereals in European Russia, namely, winter rye, oats, spring wheat, winter wheat and barley, and the profit furnished by each of these crops. The investigation is based on the replies given by farmers who are correspondents of the Section, and some institutions and persons interested in agriculture, to a list of questions addressed to them. The number of replies was 5 169, of which 3 737 related to peasant farms and 1 442 to those of large landowners.

The material collected in this way contains data concerning winter rye and oats in 60 governments, barley in 52, spring wheat in 47 and winter wheat in 47 governments. The governments of the kingdom of Poland are excluded from the enquiry. The data are grouped according to the governments and principal agricultural regions. The publication dealt with by the writer will be followed by two others, one of which will contain monographs and analytical data regarding individual farms, and the other the special local enquiries to be carried out by some zemstvos, with the financial assistance of the Section, in governments more or less typical for each of the different regions.

The data collected are digested similarly to the cereals under study; they are regrouped for the governments according to the area of the farms. The first group contains farms with an area up to 154 acres; the second, farms with between 54 and 135 acres; the third those from 135 to 540; the fourth, those from 540 to 1350 and the fifth, those of 1350 acres and upwards. Three averages are made: one for farms up to 135 acres, another for those with more than 135 acres and the third for all the farms in the government.

Without dwelling on the details of treatment of the statistical data collected, we pass on to the data relating to the great agricultural regions of Russia, which data have been combined by the writer in a somewhat different way as compared with the publication of the Section, inasmuch as in determin-

ing the percentage of each of the elements of the cost of production there has also been taken into account the cost of renting of the soil, in view of the great importance of this factor in production. The table modified in this way is reproduced here. It contains the total of all the expenses of cultivation for each cereal. This total comprises: 1) the expenses for all the labour connected with production, tillage of the soil, sowing, after management, crop, carting away from the field, threshing and cleaning the grain; 2) the cost of the grain required for sowing; 3) the cost of the manure,including the expenses of its carriage; 4) general expenses, and 5) the cost of renting of the soil. In addition, the table also indicates the cost of production of one bushel of each cereal; this cost also comprises the rent of the ground. In order, however, to determine this cost price, the value of the straw was deducted from the total expenses of production, that is to say, the cost of production of the grain alone is given, which, according to the writer, corresponds better to the actual conditions of agricultural economic life. Finally, in the table there is shown the percentage of each class of expenses relatively to the total of such expenses.

On comparing the particulars of the table, it is seen that the principal cereals grown in Russia arranged according to the cost of production fall into the following order: 1) winter wheat, 4*s.* 10*d.* per cwt; 2) spring wheat, 4 *s.* 7 *d.*; 3) winter rye, 4 *s.* 6 *d.*; 4) barley 3 *s.* 5 *d.* and 5) oats 3 *s.* 6 *d.* The writer attributes great value to the figures collected inasmuch as they allow of ascertaining the value of each of the elements of production and the relations between these elements for each cereal and for each of the regions and governments; consequently some comparisons are made.

*Winter Rye.* — The cost of production of winter rye is higher outside the zone of " tchernoziom " that in that zone, both in respect of expenses per acre (£ 2.15.2 against £ 2.6.3) and in the cost of one cwt. of grain produced (4 *s.* 9 *d.* against 4 *s.* 4 *d.*). Thus between the different regions of these two zones very great fluctuations are seen. The importance of each of the elements of rye production presents itself as follows: the highest value is that of the labour expenses; on the average throughout all European Russia they represent more than one third of all the expenses of production of cereals; in the " tchernoziom " zone the amount of labour expenses is greater than outside this zone. The two other classes of expenses — soil rent and manure — in European Russia are about the same in amount, each representing $^1/_5$ of the total expenses (20.6 and 20 %); but in the tchernoziom zone, the soil rent is the greater while in the other zone it is the manure. The sum of these two expenses gives similar values both for the tchernoziom zone and for the other, namely 39.3 % in the former case and 41.7 % in the latter. The total of these expenses is said to determine the cost of production of the rye. The next class of expenses is represented for the non-tchernoziom zone by sowing expenses, and for the tchernoziom zone by general expenses; this difference is explained by the higher cost of production of the cereals, and consequently of seeds, and by the closer sowing in the former zone; in the tchernoziom zone, by the slight amount of cultiva-

## *Cost of Production of the Principal Cereals in European Russia.*

| Agricultural districts | Expenses per acre | Cost of production of one cwt. of grain | Percentage of total expenses | | | | |
|---|---|---|---|---|---|---|---|
| | | | for land rent | for labour | for seeds | for manure | for general expenses |
| | £ s. d. | £ s. d. | I. *Winter Rye.* | | | | |
| Central agricultural. . . . . | 2.11. 8 | 0. 4.10 | 31.8 | 31.3 | 10.6 | 15.1 | 11.2 |
| Middle Volga . . . . . | 2. 4. 4 | 0. 4. 5 | 25.5 | 38.7 | 10.9 | 14.0 | 10.9 |
| Lower Volga. . . . . | 1.18. 5 | 0. 3. 3 | 14.9 | 58.2 | 9.4 | 6.0 | 11.5 |
| South-West . . . . . | 2.15. 2 | 0. 4. 1 | 24.2 | 39.2 | 10.7 | 14.7 | 11.2 |
| New-Russia . . . . . | 1.10. 6 | 0. 4. 1 | 32.0 | 41.8 | 10.7 | 3.4 | 12.1 |
| Little Russia . . . . . | 2.16. 2 | 0. 4. 8 | 27.3 | 35.8 | 8.5 | 18.7 | 9.7 |
| *Tchernoziom Zone* . . . . . | 2. 6. 3 | 0. 4. 4 | 26.4 | 39.5 | 10.2 | 12.9 | 11.0 |
| Industrial . . . . . | 2.14. 5 | 0. 5. 1 | 20.5 | 32.9 | 12.2 | 25.4 | 8.9 |
| White Russia . . . . . | 2.16. 0 | 0. 6. 0 | 19.0 | 34.2 | 12.2 | 25.0 | 0.6 |
| Lithuania . . . . . | 2. 3. 7 | 0. 3.10 | 17.7 | 39.1 | 14.6 | 19.5 | 9.1 |
| Lakes . . . . . | 3. 0. 2 | 0. 5. 2 | 15.4 | 36.0 | 13.4 | 27.4 | 7.8 |
| Baltic (1) . . . . . | 3. 5. 6 | 0. 4. 6 | 19.7 | 33.0 | 11.1 | 28.6 | 7.6 |
| *Outside the Tchernoziom zone.* . | 2.15. 2 | 0. 4. 9 | 15.7 | 36.6 | 13.1 | 26.0 | 8.7 |
| European Russia . . . | 2.10.10 | 0. 4. 6 | 20.6 | 37.9 | 11.8 | 20.0 | 9.8 |
| | | | II. *Oats.* | | | | |
| Central agricultural. . . . . | 2. 3. 5 | 0. 3. 8 | 30.8 | 33.6 | 13.3 | 9.0 | 13.3 |
| Middle Volga . . . . . | 1.16. 8 | 0. 3. 2 | 24.9 | 40.0 | 13.2 | 8.6 | 13.2 |
| Lower Volga. . . . . | 1. 9. 1 | 0. 3. 2 | 15.8 | 56.7 | 12.3 | 1.5 | 13.7 |
| South West . . . . . | 2. 7. 2 | 0. 3. 4 | 26.7 | 45.0 | 12.6 | 1.9 | 13.8 |
| New Russia . . . . . | 1.17. 3 | 0. 3. 4 | 31.8 | 41.9 | 11.7 | 1.8 | 12.8 |
| Little Russia . . . . . | 2. 5. 3 | 0. 3. 6 | 28.7 | 36.8 | 10.8 | 11.6 | 12.1 |
| *Tchernoziom Zone* . . . . . | 1.19. 6 | 0. 3. 5 | 27.0 | 40.0 | 12.3 | 7.7 | 13.0 |
| Industrial . . . . . | 2. 4. 8 | 0. 4. 0 | 14.1 | 39.2 | 18.7 | 16.1 | 11.9 |
| White Russia . . . . . | 2. 6. 6 | 0. 4. 1 | 20.1 | 36.3 | 17.7 | 14.1 | 11.8 |
| Lithuania . . . . . | 1.19. 2 | 0. 2.11 | 14.7 | 40.0 | 18.8 | 16.2 | 10.3 |
| Lakes . . . . . | 2. 8. 0 | 0. 4. 3 | 16.7 | 38.7 | 19.6 | 15.2 | 9.7 |
| Baltic (1) . . . . . | 2.10. 3 | 0. 2. 8 | 25.5 | 38.7 | 16.2 | 8.6 | 11.0 |
| *Outside the Tchernoziom zone.* . | 2. 4. 0 | 0. 3. 8 | 16.5 | 39.4 | 18.5 | 14.7 | 10.9 |
| European Russia . . . | 2. 1.11 | 0. 3. 6 | 21.5 | 39.7 | 15.5 | 11.3 | 11.9 |

(1) For the Ural region and the Northern region, no data are available as to the cost of production of winter rye, winter wheat, oats or barley.

*Cost of production of the principal cereals in European Russia.*

| Agricultural districts | Expenses per acre | Cost of production of one cwt. of grain | Percentage of total expenses | | | | |
|---|---|---|---|---|---|---|---|
| | | | for land rent | for labour | for seeds | for manure | for general expenses |
| | £ s. d. | £ s. d. | III. *Spring wheat.* | | | | |
| Central agricultural | 2.13. 0 | 0. 5. 1 | 33.2 | 33.7 | 14.6 | 6.8 | 11.6 |
| Middle Volga | 2. 1. 3 | 0. 4. 5 | 25.8 | 40.1 | 17.6 | 4.7 | 11.8 |
| Lower Volga | 1.15. 3 | 0. 3. 8 | 20.7 | 53.4 | 14.3 | 1.7 | 9.9 |
| New Russia | 2. 1. 4 | 0. 4. 7 | 32.2 | 39.4 | 14.8 | 1.7 | 11.9 |
| Little Russia | 2. 2. 9 | 0. 4.11 | 29.7 | 35.1 | 14.2 | 10.2 | 10.8 |
| *Tchernoziom zone* | 2. 4. 3 | 0. 4. 7 | 28.8 | 39.4 | 15.1 | 5.4 | 11.4 |
| | | | IV. *Winter wheat.* | | | | |
| Central agricultural | 3. 1.11 | 0. 5. 1 | 33.5 | 30.4 | 12.5 | 14.8 | 8.9 |
| South-West | 3. 4. 4 | 0. 4.10 | 24.9 | 36.4 | 11.5 | 17.3 | 9.9 |
| New Russia | 2. 5. | 0. 4. 2 | 29.7 | 41.0 | 13.8 | 4.8 | 10.7 |
| Little Russia | 2.18.10 | 0. 4. 7 | 27.3 | 34.5 | 10.7 | 18.1 | 9.3 |
| *Tchernoziom zone* | 2.17. 8 | 0. 4.11 | 28.7 | 35.2 | 12.0 | 14.4 | 9.6 |
| White Russia | 3. 1.11 | 0. 5. 3 | 20.9 | 34.6 | 12.7 | 23.8 | 8.9 |
| Lithuania | 2.12.11 | 0. 3. 9 | 17.5 | 40.8 | 16.5 | 17.5 | 7.7 |
| Baltic | 3.17. 3 | 0. 4.10 | 18.8 | 32.0 | 12.2 | 30.0 | 7.1 |
| *Outside the Tchernoziom zone* | 3. 2.10 | 0. 4. 9 | 18.7 | 35.2 | 13.6 | 24.5 | 7.9 |
| European Russia | 3. 0. 3 | 0. 4.10 | 23.5 | 35.3 | 12.9 | 19.6 | 8.7 |
| | | | V. *Barley.* | | | | |
| Central agricultural | 2. 7. 2 | 0. 4. 1 | 33.0 | 36.9 | 10.2 | 5.7 | 14.1 |
| Lower Volga | 1.15.11 | 0. 3. 3 | 21.0 | 55.1 | 8.9 | 1.7 | 12.2 |
| South-West | 2.10. 0 | 0. 3. 4 | 26.8 | 36.2 | 12.1 | 12.0 | 13.0 |
| New Russia | 1.18. 7 | 0. 3. 2 | 27.4 | 45.1 | 19.9 | 2.3 | 13.4 |
| Little Russia | 2. 6. 0 | 0. 3.10 | 29.3 | 38.0 | 11.0 | 9.9 | 11.9 |
| *Tchernoziom zone* | 2. 2. 2 | 0. 3. 2 | 28.0 | 41.0 | 11.2 | 7.1 | 12.7 |
| White Russia | 2. 9.11 | 0. 4. 1 | 21.9 | 37.4 | 14.2 | 15.6 | 10.9 |
| Lithuania | 2. 1. 1 | 0. 3. 4 | 16.5 | 41.4 | 15.8 | 16.4 | 9.9 |
| Lakes | 2.10. 8 | 0. 4. 0 | 20.0 | 37.1 | 15.4 | 18.2 | 9.2 |
| Baltic (1) | 2.14. 7 | 0. 3. 8 | 25.4 | 49.0 | 13.4 | 12.0 | 10.1 |
| *Outside the Tchernoziom* | 2. 7. 1 | 0. 4. 0 | 17.9 | 39.6 | 16.0 | 16.5 | 10.0 |
| European Russia | 2. 4.10 | 0. 3. 5 | 22.7 | 40.3 | 13.7 | 12.1 | 11.3 |

(1) For the Ural region and the Northern region, no data are available as to the cost of production of winter rye, winter wheat, oats or barley.

tion of other crops than grain crops which might be charged with a part of the general expenses.

*Winter Wheat.* — The cost of production of this grain crop is nearly the same in the two zones (4 *s.* 11 *d.* per cwt in the tchernoziom zone as against 4 *s.* 9 *d.* outside this zone), in spite of the higher expenses per acre 4 *s.* 9 *d.* more per acre in the latter zone. This uniformity is due to the higher value of the straw in the zone outside the tchernoziom, the latter having been valued in this zone at £ 1. as against 11 *s.* 4 *d.* in the tchernoziom zone. Among the different expenses of production the chief importance appertains, as in the case of winter rye, to the expenses for labour (35.4 %) ; then, for the tchernoziom zone, the second place is occupied by the rent of land (28.7 %), and outside this zone by costs of manure. For the winter wheat likewise, the total expenses for rent of land and for manure is almost equal in both zones : 43.1 % in the zone of tchernoziom and 43.2 % in the other zone, and this total is the predominating factor in the cost of production. The importance of the other classes of expenses is almost the same as in rye cultivation.

*Oats* — Among spring cereals, oats is the most widely grown. Its cost of production in the zone lying outside the tchernoziom region is slightly higher than in the latter zone 3 *s.* 8 *d.* as against 3 *s.* 5 *d.* per cwt); the biggest regional fluctuations of this cost are observed in the zone lying outside the tchernoziom zone.

*Barley.* — Its cost price is greater in the zone outside the tchernoziom than in the tchernoziom zone (4 *s.* per cwt as against 3 *s.* 2 *d.*).

*Spring Wheat* — Its cultivation is concentrated in 5 regions of the tchernoziom zone. The cost price for all these regions is 4 *s.* 7 *d.* per cwt of grain ; the fluctuations between the different regions are very great.

With respect to the importance of each class of expenses in the growing of spring cereals, it may be repeated that the most important one, *i. e.* the highest relative amount, is represented by the costs for labour, and this importance is even greater than for the winter cereals. The second place in respect to all spring cereals in the tchernoziom zone falls to expenses for rent of the soil ; outside the tchernoziom, in the case of oat cultivation, to the expenses for rent of the soil, the latter being of almost equal amount in both cultivations : in respect of barley the expenditure for manure again is similar in importance or amount. It is furthermore necessary to point out that in spring cereal growing the expenses for manure are relatively more considerable than for winter cereals.

907 – **Wheat-growing on the Share-farming System in the State of Victoria, Australia ; Results obtained in 1915.** — *The Journal of the Department of Agriculture of Victoria, Australia*, Vol. XIV, Part 3, pp. 179-180. Melbourne, March 10, 1916.

In 1905, the Department of Agriculture in Victoria asked farmers in that State to sow the largest possible area with wheat in anticipation of good prices. Unfortunately, a number of these farmers, having suffered severely owing to failure of the previous harvest through drought, did not possess the necessary funds to increase their wheat sowings. This fact led several city investors to take an interest in the question, and they expressed

a wish to invest money in wheat-growing. The Department of Agriculture then undertook to put the farmers into communication with the capitalists, and a number of the latter concluded arrangements under which their financial aid was afforded for the purpose of more extensive wheat sowing.

One of them sent the Department of Agriculture a summary of the results of his investment. He supplied the necessary funds for cultivating on the share farming system 204 acres in Borung and 500 acres in the Mallee, that is to say, he paid the farmer a given sum for putting in and taking off the crop, supplied $^2/_3$ of the seed and manure, and in exchange took for his account $^2/_3$ of the crop. The results obtained are set out in the appended Table.

I. — *Borung.*

*Expenditure.*

| | £. s. d. |
|---|---|
| (1) Cash advance to farmer for working 204 acres of land at £ 1 per acre | 204. 0. 0 |
| (1) Seed wheat ($^2/_3$) at 7*s.* per bushel | 50. 0. 0 |
| (3) Two thirds of the cost of 5 tons of superphosphate | 15. 10. 3 |
| (4) Sacks | 35. 15. 0 |
| Total cost £ | 305. 5. 3 |

*Receipts.*

Investor's share ($^2/_3$) of wheat: 2934 bushels

II. — *Mallee.*

*Expenditure.*

| | £ s. d. |
|---|---|
| (1) Cash advance to farmer for working 500 acres of wheat at 16 *s.* | 400. 0. 0 |
| (2) Seed wheat ($^2/_3$), purchase and carriage | 74. 9. 0 |
| (3) Manure ($^2/_3$) | 25. 1. 0 |
| (4) Sacks, purchase and carriage | 44. 14. 6 |
| (5) Carriage of wheat to railway station, 8 miles | 41. 2. 0 |
| Total cost £ | 586. 6. 6 |

*Receipts.*

Share of investor: 3 744 bushels of wheat and 52 tons hay.

Thus the total sum invested by the capitalist in this undertaking, £ 890.19.9, yielded him 6678 bushels of wheat at the railway siding, and 52 tons of hay.

Deducting from this sum the value of the hay at 30 *s.* a ton the grain would have cost the investor £ 813 in all or 2*s.* 5 ¼ *d.* per bushel. Therefore he can realise a considerable profit on its sale, as the price of wheat *f. o. b.* in Victoria is at present 5*s.* 3 ½*d.*

The two farmers and the capitalist are so satisfied with their joint operations that they have entered into fresh contracts for still further extension of wheat-growing over 1000 acres this year.

908 – **Strawberry Farming as an Exclusive Cultivation in the South of the United States.** — *The Southern Fruit Grower*, Vol. XX, No. 5, pp. 101-102. Chattanooga, Ten. May 1916.

In the Southern part of the United States of America the cost price of strawberries relatively to the unit of area varies of course within fairly wide limits. In view, however, of the extension undergone by this cultivation in many Southern States, where there are numbers of farms engaged exclusively in strawberry growing, and where instances of farms cultivating more than 740 acres of strawberries and employing from 2000 to 3000 work-people at harvest time are not wanting, it is interesting to publish the average data relating to the expenses and production per acre as they result from a large number of statements issued from the United States Department of Agriculture.

The costs of cultivation, cropping and packing per acre vary within the following limits, the lowest of which is considered to be the average of the greater part of the producing centres, while the highest must be regarded as an extreme limit only reached in some parts where the crops are exceptionally early, such as Florida.

| | |
|---|---|
| Interest on capital invested | $ 8 to $ 15 |
| Preparation of Land | 5 to 10 |
| Manure | 10 to 25 |
| Plant purchased | 10 to 20 |
| Setting lants | 8 to 12 |
| Cultivation, hoeing | 20 to 35 |
| Mulching | 15 to 25 |
| Total cost per acre for first year | 76 to 142 |
| Costs of picking, sorting and packing for an average crop of 2 000 quarts per acre | 40 to 72 |
| Crates and Boxes | 20 to 25 |
| Costs of carriage to railway etc | 5 to 10 |
| Total expenses of cultivation and sale | 141 to 247 |

Many strawberry growers secure a yield of 3 000 quarts per acre and yields of 4 000 and 5 000 quarts to the acre are not uncommon. A yield of 2 000 quarts is required to make the crop at all remunerative. The low prices ruling for strawberries at the time of greatest production have often caused losses to the growers ; some of them have found themselves under the necessity of leaving from 20 to 25 % of the crop on the field. This drawback is about to disappear owing to the creation of industries which will convert the strawberries into jam, etc., in the centres of production. The manufacturers in some cases, treat the strawberries on the spot, with an equal proportion by weight of sugar. They are put up in barrels and loaded in refrigerator cars, and sent to a cold-storage plant where they are kept until needed.

Some growers are at the present time studying the question of creating co-operative jam factories, with a view to utilising those strawberries

which are not adapted for putting on the market, being over-ripe, and also the question of the utilisation of the crop generally at times of over-production and fall of prices for fresh strawberries.

909 - **Cost of Milk Production in the County of Jefferson, State of New York, United States of America.** — HOPPER H. A. and ROBERTON F. E., in *Cornell University, Agricultural Experiment Station of the College of Agriculture*, Bulletin 357, pp. 135-162, fig. 60-65. Ithaca, N. Y., March 1915.

In order to ascertain the cost of milk production, the county of Jefferson, New-York, was selected. This is one of the New-York counties where agriculture is most progressive : it produces cereals, forage, etc., and it is inferior to two only of all the other counties in the number of dairy cows bred there. The bulk of the milk production is converted into cheese, although the trade in milk itself has made rapid strides of late years.

The organisation of a farm bureau in the county, which took place in April 1912, allowed of obtaining the data set out in the Bulletin in question. The bureau founded three societies for testing milk production, including 653 herds distributed through the different parts of the county. Registration for one year of the production of 834 cows resulted in the following facts :.

TABLE I. — *Average Production, Cost of Production and Profit for* 834 *cows.*

| Item | Production per cow (lbs.) | Cost | | |
|---|---|---|---|---|
| | | per cow | per 100 lbs. milk | per 1 lb. butter-fat |
| Milk yield | 6621 | | | |
| Butter fat | 241 | | | |
| Cost of feed | | $ 51.57 | $ .78 | $ .214 |
| Fixed costs | | 35.65 | .54 | .148 |
| Interest on investment in cow plus hauling costs per cow | | 11.25 | .17 | .047 |
| Total gross cost of production | | $ 98.47 | $ 1.49 | $ .409 |
| Credit by calf and manure | | 18.23 | .28 | .076 |
| Net cost of production | | $ 80.24 | $ 1.21 | $ .333 |
| Value of production | | 100.63 | 1.52 | — |
| Average profit | | $ 20.39 | $ .31 | — |

The cost of pasturage per month per cow varied in the different Societies from $ 1 to $ 1.5. The average spot value of mixed hay was $ 12 per ton. Ensilaged maize (forage) was reckoned at the rate of $ 4 per ton. The average cost of concentrates purchased was $ 30 per ton. The net average annual cost of feeding one cow was $ 51.57 or 64 % of the net average cost of maintenance.

TABLE II. — *Relation of Yield to Cost and Profit for 834 Cows. Comparison of Groups of Different Productive Ability.*

| Group | Number of cows in group | Average cost of production | Net cost of production | Value of production | Profit per cow | Net cost per 100 lbs of milk | Profit per 100 lbs of milk |
|---|---|---|---|---|---|---|---|
| 5 000 lbs or less . . . . | 159 | 4 161 | $ 57.20 | $ 63.24 | $ 6.04 | $ 1.37 | $ .15 |
| 5 001–7 000 lbs. . . . . | 360 | 5 993 | 74.20 | 91.09 | 16.69 | 1.24 | .28 |
| 7 001–9 000 lbs. . . . . | 214 | 7 843 | 92.00 | 119.21 | 27.21 | 1.17 | .35 |
| 9 001–11 000 lbs. . . . | 84 | 9 763 | 109.00 | 148.39 | 39.39 | 1.12 | .40 |
| over 11 000 lbs. . . . . | 17 | 12 377 | 112.60 | 188.13 | 75,53 | .91 | .61 |
| Total . . . | 834 | — | — | — | — | — | — |
| Average . . . | — | 6 621 | $ 80.24 | $ 100.63 | $ 20.39 | $ 1.21 | $ .31 |

The interest on the capital invested was reckoned at 5 %. The interest on the value of a cow was not assessed at more than 5 dollars nor the value of a calf at more than 10 dollars. The value of the manure produced in one year was reckoned at 15 dollars for a cow and 10 dollars for a bull. The cost of labour for milking and the care of the cow was fixed at 15 cents per hour of labour.

In Table I the most important figures relating to production, the expenses incurred thereby and the profit yielded are condensed. Table II indicates the relative profit furnished by individuals possessing different milk-producing powers.

In the study of the herds separately, it was observed that 7 out of 53 were kept at a loss of $ 1335.71. On the basis of the net cost of maintenance and the sums recovered, it was found that 161 cows representing 19 % of the total number of heads, occasioned their owners a loss of $ 1799.87, or $ 11.18 per cow.

The average cost of labour for tending each cow was $ 23.12 The average cost of conveying 100 lbs. of milk to a distance of 2.14 miles amounted to 11.7 cents. The profit yielded by each cow producing 10 000 lbs. of milk in the year exceeded by 51 % that given by each cow producing only 6 000 lbs.

910 – **Monograph on a Small Dairy Farm in Illinois.** — BILL A. J., in *Hoard's Dairyman*, Vol. LI, No. 7, pp. 282 and 286. Fort Atkinson, Wisc., March 10, 1916.

The University of Illinois Dairy Department has published the results of a monograph study of a small dairy farm in the county of Stephenson which forms a typical example of the well managed cultivated farm in this region which is devoted to agriculture. The data furnished by a study of the analytic accounts kept on the farm may be summed up as follows.

The farm in question has an area of 96 acres of an average value of $140 per acre. On the farm 16 cows are constantly kept, and their milk is converted into butter which is sold exclusively to private customers in the town of Freeport.

Out of the heads under which the working of the farm was classified, twelve yielded a profit of $ 2006.86 and four left a net loss of $ 25.40. Thus for the year there remains a net revenue of $ 1981.46 or $ 20.64 per acre, made up of $ 868.16 interest at 5 % on the total capital invested in the farm, and $ 1113.30 profit in the strict sense. The farmer owner drew from his farm, in addition to the above revenue, $ 700 as wages for his labour and that of one son, and $ 186.30 for the board and lodging of a permanent farm hand. The total revenue of the farmer owner therefore amounts to $ 2867.76 or $ 30 p. acre cultivated. The total household expenses of the farm amounted to $ 1802.24 ; there remains therefore a saving of $ 1065.52, or $ 11.10 per acre ; it is expedient, however, to remark that the household expenses include $ 42.155 used for education and charitable purposes ; these cannot be considered as strictly living expenses.

The principal receipts of the farm are from the dairy cattle, which in all gave a gross return of $ 2,868.95 divided as follows : $ 1,854.62 of butter sold (66 % of the dairy receipts), $ 38.52 of butter and milk consumed by the household, $ 44.70 of butter milk, $ 165.11 of skim milk, $ 220 of manure, and $ 546 from the sale of cattle (17 % of the total cattle receipts)

The dairy, however, defrays a large portion of the expenses of the farm, namely : $ 575.45 for the remuneration of manual labour, $ 106.16 for horse labour, $ 113.13 for maintenance of equipment, $ 120 for maintenance of buildings, $ 105.34 for interest on investment, $ 43.55 miscellaneous, $ 128.57 fat bought, and $ 1206.14 for feed ; a total cost of $ 2,398.34.

This leaves $ 470.61.

The average value of the dairy cattle is $ 74.37 per head ; that of the 10 head of young cattle is $ 39.75.

The total value of the food consumed, is divided as shown by Table I.

TABLE I. — *Distribution of total value of food consumed.*

| | | | |
|---|---|---|---|
| Ground maize | $ 101.25 | Silage | $ 360 |
| Forage gluten | $ 86.25 | Lucerne | $ 60 |
| Bran | $ 105.19 | Clover | $ 140 |
| Oil meal | $ 34.45 | Green forage maize | $ 12 |
| Barley | $ 30 | Straw | $ 35 |
| Oats | $ 15 | Pasturage | $ 22.7 |

The portion consumed by the dairy cattle amounts to $ 1016.65 in the following proportions : 34.7 % grain, 47.6 % roughage, 17.7 % pasturage.

The average return of each dairy cow is made up as follows : $ 115.91 for butter, $ 15.52 for butter milk, skim milk and products consumed by the household, $ 13.75 for manure, $ 29.75 from sale of cows and calves and increase of live weight, making a total return of $ 174.93 per cow.

Table II brings out clearly the high amount of the individual production.

TABLE II. — *Individual Production of Cows.*

| No. of cow | Age | Fat produced | Milk produced |
|---|---|---|---|
| 36 | 4 years | lbs. 447 | lbs. 10 678 |
| 37 | 7 | 430 | 11 764 |
| 44 | 2 | 208 | 6 083 |
| 24 | 3 | 328 | 8 892 |
| 33 | 5 | 379 | 10 757 |
| 42 | 3 | 320 | 11 252 |
| 40 | 3 | 259 | 7 060 |
| 38 | 4 | 285 | 8 164 |
| 43 | 2 | 266 | 7 629 |
| 39 | 3 | 302 | 8 904 |
| 21 | 9 | 318 | 9 734 |
| 41 | 5 | 342 | 6 443 |
| 35 | 5 | 267 | 7 908 |
| | Total | 4 051 | 115 268 |
| | Averages | 312 | 8 867 |

This production of milk furnishes in all 5 509.5 lbs of butter of an average price of 33.7 cents.

With regard to the expenses for each dairy cow, they are made up as follows : $ 75.38 for food, $ 42.61 for labour, $ 31.91 general expenses ; total $ 149.90.

Thus a net profit of $ 25.03 per dairy cow remains, including the calves and the butter manufacture in the valuation. Without these two last factors, the net profit per cow drops to $ 11.84 with a cost price of $ 63.54 for food and an expenditure of $ 29.05 for labour ; in all, an annual outlay of $ 108.12 per dairy cow.

The calculation of the receipts, made for each cow alone, *i. e.* independently of the production of young animals and of butter manufacture, yields an individual profit of $ 84.02 represented by the market value of the fat in the milk (calculated as such and not in the form of butter), and a total individual value of $ 119.96. In this method of calculation each pound of fatty substance in the milk costs 37.5 cents and fetches 41.5 cents leaving a profit of 4 cents.

The 12 tables in which the expenditure and profits of each cow are fol lowed up in their variations during the various months of the year present a special interest. Another table separates the production of the 7 winter months from that of the 4 summer months. The winter period furnished 2505 lbs. of fat and the summer period 2902 lbs., the feeding expenses fell from $ 100.58 per month during the winter to $ 62.52 per month during the summer period. The costs of labour (looking after the cattle, etc.) also decreased, dropping from $ 40.15 during the winter period to $ 36.74 during the summer period.

The young cattle (10 head) have an average gross yield per head of

$ 36.28 against an average expenditure per head of $ 28.11., with a profit of $ 8.17 per head, which proves that from raising a good breed of dairy cattle a profit per head may be obtained which is only 1/3 below that yielded by the dairy cattle themselves. From an examination of the sale of butter in reference to its cost price it is found that the cost of making and selling is 32.1 cents per lbs. The butter sells at 33.6 cents per lb. and if allowance is made for the butter milk, the income is raised to 34.4 cents, leaving a gain of 2.3 cents per lb.

The number of hours of labour was, during the course of the year 6 952 and the cost was $ 1275, which is equivalent to 2.2 labourer units.

The hired labour furnished by a permanent workman cost $ 388.81 for wages and $ 186.30 for board and lodging. The work of the farmer's son was estimated at $ 160, and that of the working farmer at $ 600 ; the latter did 47 % of the total work ; 45 % of the total work was absorbed by the dairy cows.

The distribution of the work during the year comprises : 457 hours per month for January, February and March; 611 hours per month for April, May and September ; 741 hours per month for June, July and August ; and 507 hours per month for October, November and December, with an average of 579 hours of labour per month.

The work of the horses is divided as follows : 210 hours per month for January, February and March, 577 hours for the 5 following months, and 387 hours for the last 4 months.

The manual labour is subdivided as follows : 46.8 % for the dairy cows and dairy and 53.2 % for all the other labour ; the horses' work : 16.6 % for the dairy cows and 83.4 % for all the other work.

The results as regards cultivation are as follows : 15 acres of maize, with a yield of 51 bushels per acre, a value of $ 28.89 per acre and a profit of $ 3.35 per acre ; 8 acres of maize for ensilage, with a yield of 11 tons per acre worth $ 450.12 per acre, costing $ 441.63 and giving a profit of $ 8.49 per acre ; 20 acres of oats with a yield of 45 bushels per acre worth $ 19.79 against a cost of $ 14.02 and a profit of $ 5.75 per acre ; 3 acres of barley, which showed a slight loss, and 3 acres of lucerne, also worked slightly at a loss, as there was only the catch crop with oats ; 18 acres of clover yielded 1.6 tons per acre worth $ 16.86 against a cost of $ 13.53, and a profit of $ 3.33 per acre.

## AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

911 – **A Palm Fruit Used for Flavouring Brandy.** — GRIEBEL C. and BAMES E., in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*, Vol. 31, No. 9, pp. 282-290. Munster i. W., May 1st. 1916.

In order to give the different varieties of brandy a special taste, flavouring materials are often used, which are mostly extracts from certain varieties of prunes, green walnuts, almond shells, etc. The writers describe a drug of this kind which is marketed under the name of " Bayas negros "

and has not yet been thoroughly studied, probably because morphologically it resembles a small prune. An attentive study showed that this drug is the fruit of the palm *Serenoa serrulata* Hook f., which grows in South Carolina and Florida.

According to the publications in connection with this subject the fruits of *Serenoa serrulata* are used to prepare an extract, the " Saw palmetto ", used chiefly in North America as a remedy for pulmonary diseases, but they do not furnish other particulars with regard to this drug. The writers therefore proposed to study it after obtaining fruits of *Serenoa* from North America and some " Saw palmetto ". They describe in detail the results of their researches.

The fruit is oval, contains a single seed and weighs from 1.5 to 3 gr. Its pericarp, which is clearly divided into epicarp, mesocarp and endocarp, contains the greater part of the aromatic substances. The physical composition of the fruit is as follows :

| | | |
|---|---|---|
| Pericarp | Epicarp | 36 % |
| | Mesocarp | 16 |
| | Endocarp | 10 |
| Seed | | 38 |

The chemical composition of the pericarp is as follows :

| | |
|---|---|
| Water | 15.41 % |
| Dry matter | 84.59 |
| Mineral matter | 5.74 |
| Chlorides such as Na Cl | 1.52 |
| Fat (ether extract) | 26.75 |
| Invert-sugar | 28.20 |
| Extract free from sugar and soluble in water | 16.34 |
| Insoluble matter | 13.30 |

More than one fourth of the weight of the pericarp is therefore made up of fatty matter.

The strong rancid odour of the pericarp at once suggested that its fat contains a large quantity of free acids. It was in point of fact found that the smell and state are chiefly due to free acids, probably caproic acid and other acids of low molecular weight. The crude fat extracted by ether is an oil of dark orange colour, yielding on analysis the following results :

| | |
|---|---|
| Refractive index at 40 degrees | 31.2 |
| Iodine index | 44.1 |
| Acid index | 201.4 |
| Saponification index | 229.0 |
| Reichert-Meissl index | 9.5 |

The crude fat contains : 75 % of fatty acids and 25 % of neutral fat.

This analysis suggests the presence of an enzyme decomposing the fatty substances in the pericarp of *Serenoa*. Studies carried out with a

view to ascertaining this did not give conclusive results, but it is beyond doubt that a lipase does exist. It would seem that this lipase disappears during or after the ripening of the fruit.

The high content of fatty acids in the crude fatty matter is by no means abnormal for a fat originating from a palm fruit. It is precisely to these acids that the fruit owes its characteristic odour and its use in the manufacture of flavouring substances. An important part. however, is also played by an etherifying enzyme, as is particularly shown by the experiments with the American " Saw palmetto ". On extracting the fruit with dilute alcohol, a liquid is obtained containing ethers the smell of which strongly suggests essential oil of grape (essence of brandy). Probably there is not one only but two enzymes acting in contrary directions, one of which decomposes the glyceric ethers of the fatty acids into acid and alcohol while the other once again etherifies the free fatty acids by means of monovalent alcohols. The action of the enzyme does not appear if the fruits of *Serenoa* are first treated with bichloride of mercury or other toxic substances.

From these observations it is concluded that the addition of an extract from *Serenoa* fruits to brandy may produce the impression of the presence of a percentage of substances imparting the natural flavour much higher than the actual percentage. This extract therefore must not be put into the same class with the other extracts (prunes, green walnuts, etc.) ordinarily used for flavouring brandy, as it does not merely flavour the latter, but " doctors " it, so to speak, and is use was rightly prohibited 2 years ago in Germany in brandy manufacture.

912 - **Experiments in connection with Spinning Cotton after Fumigation with Hydrocyanic Acid.** — Dean Williams S., in *United States Department of Agriculture, Bulletin* No. 366, 12 pp. Washington, D. C., April 24, 1916.

To prevent introduction of the pink boll-woorm (*Gelechia gossypiella*) (1) in imports of foreign cotton, the Federal Horticultural Board of the United States of America found fumigation with hydrocyanic acid effective. It destroys the larvae even in the centre of a compressed bale of cotton. With a view to ascertaining whether these fumigations injure the fibres of the cotton the Department of Agriculture had practical spinning tests carried out at the New Bedford Textile School with two kinds of cotton, one part of which had been subjected to fumigation and the other had not. The results showed that the fumigations of cotton with hydrocyanic acid have practically no ascertainable effect upon the proportion of waste, the quality of the yarn, tensile strength, or the bleaching, dyeing and mercerising qualities of the cotton.

(1) See *B.* March 1913, No. 213, *B.* Sept. 1913, No. 1119 and *B.* June 1916, No. 714 (*Ed.*).

913 - **Factors Affecting the Fat Content of Whole and Skim Milk.** — GUTHRIE E. C. and SUPPLEE G. C., in *Cornell University, Agricultural Experiment Station of the College of Agriculture, Department of Dairy Industry, Bulletin* 360, pp. 271-289, fig. 117-125. Ithaca, N. Y., April 1915.

Several factors influence the fat content of cream obtained with a separator (independently of the variations of such content due to displacements of the regulating device), *viz*: the temperature, speed, rapidity of feed, content of fat in the full cream milk, the variations in the quantity of liquid (skim milk or water) which is passed through the drum of the separator at the close of the operation in order to force out the residue completely, or, as is the case in practice, in the quantity of whole cream milk used for this purpose, and the quantity of milky deposit formed.

In order to determine the nature of these influences, the writers undertook the experiments described in the Bulletin in question, making use of different types of separator. The results proved the following :

The influence of low temperatures (the operations were conducted at temperatures varying from 21.1° to 32.2° C) on the percentage of fat in the milk and the skim milk varies with the different types of separator. The results, which are particularly conclusive for two types of separator, seem to demonstrate that, all other things being equal, when the temperature is lowered the quantity of cream extracted is diminished, but that the weight of the fat contained in this cream remains constant.

With some types of separator the percentage of fat in the cream varies markedly even for a variation of 10 revolutions per minute in the revolution counter (corresponding to 1 500 revolutions per minute in the drum); on the contrary, other types exhibit this influence in a much less degree. In regard to the types of separator which showed variations in the percentage of fat, the writers find that when the speed diminishes the weight of the cream obtained increases, which was obvious *à priori*, but that the weight of fatty matter contained in the cream still remains constant. A variation of 10 revolutions per minute in the counter had no appreciable influence on the percentage of fat in the skim milk. The percentage of fat in the cream is practically directly proportional to the percentage of fat in the full cream milk. It increases slightly when the milk enters the drum slowly. The variation in the quantity of full cream milk utilised, or in the quantity of liquid employed to force the remaining cream out of the drum at the end of the skimming, has but little influence on the percentage of fat in the cream.

The milk deposited has only an insignificant influence on the percentage of fat in the cream and the skim milk, provided its quantity is not sufficient to choke up the passage through the drum.

914 - **Metallic Taste in Dairy Industry Products.** — GUTHRIE E. S. in *Cornell University Agricultural Experiment Station of the New York State College of Agriculture, Department of Dairy Industry, Bulletin* 373, pp. 605-644, 19 tables. Ithaca, New York, April 1916.

The metallic taste, which influences the price of dairy industry products, was first detected in 1901. The writer entered into correspondence with a large number of experts in order to determine exactly what is to be

undestood by " metallic taste ". According to these experts, such taste is closely akin to the fishy taste of oil, tallow, etc. ; it is difficult to detect, but, nevertheless, qualified men succeed in detecting it when they have become familiar with it.

The writer studied the conditions under which the metallic taste appears in dairy products. He found that the direct absorption of metals may produce this flavour. His observations have furthermore demonstrated that a high content of acid seems essential for the development of the taste, which is more likely to appear during the very hot season. Furthermore, with the exception of butter milk, the taste only appears when the fat content is high. The taste appears suddenly, and low temperatures very often make it more noticeable.

Besides the direct absorption of metals, bacteria may produce the metallic taste. A quantity of butter milk put into sterilised bottles was found to have this flavour in some cases. In 241 samples of cream placed in sterilised glass bottles the metallic taste was produced in 79 by the inoculation of butter milk having that flavour ; likewise in 167 samples of cream put into sterilised glass bottles the taste was produced in 52 by inoculation with bacteria.

The writer has studied the microflora of products having a metallic taste ; he found on the other hand that the addition of formaldehyde only rarely prevents the occurrence of the taste, which appeared 35 times in 41 samples of butter milk of which there had been added, per 100 cc., from 2 to 30 drops of a solution containing 37 to 40 % of formalmaldehyde.

Finally the writer endeavoured to ascertain the relation between the production of enzymes and the appearance of the flavour by utilising products which prevent the growth of bacteria but allow of enzyme action. For this purpose toluene and chloroform were used : the results were not satisfactory, owing to the difficulty of distinguishing and analysing the taste of the liquids treated with these antiseptics. Nevertheless, it seems that the metallic taste can be produced by the action of enzymes.

In the inoculation experiments it was found that the bacteria capable of producing the metallic taste appear to be the same as the well known bacteria found in milk, and belonging to the group *Bacterium lactis acidi ;* the only difference, if any, was that the former were a little larger than the types representing the group, but only very slightly. It is therefore concluded that the organism which causes the metallic taste is a member of or derived from the group *Bacterium lactis acidi.*

In an appendix, a bibliographical note gives a list of 8 works .

915 - **The Production of Beef in South Africa.** — Holm Alex, in *The Agricultural Journal and Small-Holder of South Africa*, Vol. III, No. 16, pp. 104-109. Johannesburg, April 1916.

The production of beef in the South African Union has made rapid strides of late years, particularly during the last two years.

In 1911 the Union possessed 3 500 000 cattle. In 1914 there were 5 797 000. The writer estimates their number at about 8 000 000 in the first half-year of 1916. In 1903 the value of imports of beef and mutton

amounted to £ 2 885 000. This figure continually declined until 1915 when it had fallen to absolutely insignificant proportions (£ 593).

On the other hand, in 1914 there were exported 532 358 lbs. of meat of a value of £ 12 352. In 1915 the exports were 32 897 quarters of beef, and in the first 11 months of the same year the meat exports totalled 6 211 752 lbs. of a value of £ 113 296.

In 1915 South African beef fetched on the London market from 5 ½ *d* to 7 ½ *d*. per lb. or from 2 *d* to 3 *d* per lb. more than it would probably have fetched before the war. The cost of exportation. allowing for the value of the by-products, is probably about 1 ½ *d*. per lb.

In order to ensure still further the progress of this industry, it is advisable to use good bulls of a beef breed, so as to obtain earlier maturity, heavier carcases and better adaptation for fattening.

At present South African cattle are chiefly draught animals. They only attain maturity at the age of 6 years, and their quarters weigh from 110 to 160 lbs., while those, of Argentine cattle for instance, average 180 to 200 lbs.

916 - **Experiments in Potato Storage with Sulphur.** — GERLACH, in *Illustrierte landwirtschaftliche Zeitung*, 36th Year, No. 37, pp. 268. Berlin, May 6, 1916.

AGRICULTURAL PRODUCTS : PRESERVING, PACKING, TRANSPORT, TRADE

Reference is made to an experiment in potato ensilage carried out on the Mocheln model farm in order to test sulphur as a preservative. On the 29th October, 2 stacks of potatoes of the "Ella" variety were put into earth silos about 16 ins deep. Each stack contained 2 200 lbs. of hand-sorted tubers. The potatoes were laid on a thin layer of straw, then successively covered with a layer of straw, earth, and potato leaves and stalks, and, when winter approached, with a second layer of earth. Silo N° 1 received no addition of sulphur ; in silo N° 2 there was first placed a thin stratum of crude powdered sulphur, then a 9 to 12 inch layer of potatoes, and so forth. On the 22nd April following the silos were opened, and the potatoes sorted and weighed. The following were the results found : silo N° 1 contained 2048 lbs. of healthy and 19 lbs. of rotted potatoes; silo N° 2 had 2099 lbs. of healthy and 35 lbs. of rotted potatoes. Thus the rotting of the potatoes was not prevented by sulphur, but the latter impeded the reduction of weight in the potatoes.

917 - **Investigations into the Part Played by the Amylase in Potato.** — See this *Bulletin*. No. 851.

918 - **Experiments in Preserving Broken Eggs.** — EICHELBAUM GEORG , in *Biochemische Zeitschrift*, Vol. 74, No. 3 and 4, pp. 176-184. Berlin, April 29, 1916.

At the suggestion of the Central German Egg Purchasing Company the writer carried out preservation tests by different means. The object was to find a substance which can be added to the thoroughly stirred liquid mass of broken eggs, thus enabling the latter to be transported in barrels to long distances.

The preliminary tests showed that substances with strong odour cannot be used, as it is afterwards impossible to free the eggs from the odour communicated to them. The writer indeed showed that even highly vola-

tile liquids, such as toluol and chloroform, impart their smell to eggs and cannot be entirely got rid of. Eggs preserved by the aid of these substances are no longer fit for consumption.

A study was made of the action of the following substances: toluol, chloroform, hydrochloric acid, acetic acid, mustard oil, benzoate of soda, boric acid, and salicylic acid. As time did not allow of keeping the eggs for a very long period, the conditions of lengthy transport were imitated by carrying out the experiments at a temperature of 37 to 38° C., at which the eggs were kept for 10 to 14 days. The eggs used were not entirely fresh, being market eggs.

The results of the experiments may be summarised as follows :

| | |
|---|---|
| *Toluol* . . . . . | The smell and taste imparted to the eggs cannot be removed. |
| *Chloroform* . . . . . | Do. |
| *Hydrochloric acid* . . | When used in the proportion of 0.5 % the eggs are liable to rot and mould. |
| *Acetic acid* . . . . . | When used in the proportion of 0.65 % rotting is prevented but the eggs acquire a sour taste and coagulate. |
| *Benzoate of soda* . . . | When used to the amouut of 1.75 % the eggs decompose and rot within 8 or 9 days. |
| *Salicylic acid* . . . . | Used in the proportion of 1-2 %, no rotting but deleterious change in colour and smell. |
| *Mustard Oil* . . . . . | Strong smell of mercaptan; eggs no longer fit for consumption. |
| *Boric acid* . . . . . | Used in a quantity of 1-2 %, no rotting after keeping for 12 days. |

Conclusions. — For the preservation of broken eggs, only acetic acid, salicylic acid and boric acid give a sufficiently good result, but they must be used in fairly strong doses. The eggs nevertheless retain some flavour due to the preserving agent, and undergo chemical changes. The best preserving agent is undoubtedly boracic acid, the use of which in Germany however meets with great difficulties on the part of the authorities ; it is thought that the preservation of broken eggs should only be resorted to in exceptional cases, when any other means of keeping them is impossible. It is nevertheless recommended that these experiments should be repeated.

919 – **Sale of Cattle through the Agency of Co-operative Shipping Associations in the United States.** — Doty S. W. and Hall L. D., in *United States Department of Agriculture, Farmers' Bulletin*, No. 718, pp. 1-16. Washington, April 10, 1916.

In those parts of the United States where cattle breeding is not one of the most productive branches of farming, and especially wherever the dairy industry predominates, the majority of farmers have only a small number of animals available for sale at a given moment. This number is generally insufficient to load complete trucks, but exceeds the needs of the local markets and must be disposed of at more distant markets.

This state of things, which cattle dealers were not slow to turn to account, has led to the creation among farmers of co-operative cattle-forwarding societies. Examples were not wanting, even in the past, of farmers coming to an agreement to effect this class of forwarding, but it is not until the last 7 years that these associations arose and developed (first starting in 1908 at Lichtfield, Minnesota).

At present the United States Department of Agriculture records the existence of about 500 societies of this kind. There are 200 in Minnesota alone, and the others are found, in decreasing order of number, in the following States : Wisconsin, Nebraska, Iowa, North Dakota, South Dakota, Kansas, Michigan, Illinois, Indiana and Ohio.

The annual increase in the number of trucks forwarded by the different societies proved clearly that farmers have rapidly appreciated the advantages of these institutions. It is estimated that in Minnesota alone $6 000 000 worth of cattle were sold in 1914 through co-operative forwarding and selling societies.

The expenses of sale for 1913 and 1914 averaged 33 cents per cwt. to the Lichtfield society. Farmers are of opinion that this cost is from 10 to 40 cents per cwt. below the allowance which dealers made the basis of their offers to farmers. Assuming that the allowance imposed by the buyers was only 50 cents per cwt. the Lichtfield association will have saved the forwarders about $ 6221 in 1914.

The simplicity of organisation, and the fact that no capital is required, render the collective sale of cattle very interesting in rural districts, where more complex forms of co-operative societies are more difficult to establish.

The principal conditions required for the success of these societies are: an able manager and full confidence on the part of members. The manager must be well known in the region and must be regarded as a man thoroughly at home in the cattle trade, and one in whom farmers can place entire confidence.

Practice has shown that in order to avoid possible mistakes it is indispensable to number and brand each animal at the forwarding station, even in the case of pigs or sheep, and to make a note of all such particulars as may be required to be taken into account by the manager with a view to a fair distribution of the expenses and profits, or possible losses.

Farmers were quick to realise that the profits previously made by the cattle dealers thus went into their pockets, because through the agency of the society they really sell at the genuine market price less the actual selling expenses. Moreover, the work of an able society manager exerts an influence throughout the region in the direction of improving the methods of cattle breeding, and rendering farmers more familiar with the real market prices. These indirect benefits are no less important than those obtained direct by the members of different societies.

920 – **Control of the Sale of Skim Milk.** — Bordas F., in *Annales des Falsifications* Nos. 90-91, pp. 146-156. Paris, April-May, 1916.

After having rapidly considered the various operations of industrial commercial separating and the chemical and biological characteristics of skim milk, the writer opposes the current opinion that skim milk is simply milk deprived of its fat. He lays stress on the fact that it is an incomplete food which has also lost its glycero-phosphoric acid, and been enriched on the other hand with numerous micro-organisms. After a study of the dietetic value of skim milk and a reference to the works published on the question, chiefly in Denmark, the attempt is made to show that the require-

ments of infants cannot be satisfied by giving them milk deprived of its fatty matter. It is shown that it is not a matter of indifference from the physiological point of view what is the age of the milk given to a new-born child. The milk given to an infant should be suitable for the age of the child. On the other hand, from the economic point of view, the writer proves that it is not in the producer's interest to sell milk skimmed to the extent of 85 % and still less entirely skimmed milk. This trade apparently can only be remunerative if the skim milk is sold at the same price as the whole milk. The writer therefore thinks it desirable to record the conclusions adopted by the Society of Technical Chemists of France at its sitting of the 10th May 1916, with which he is in complete agreement.

In view of the fact that the prevention of frauds due to the mixing of skim milk with natural milk presents the utmost difficulty:

The Society of Technical Chemists of France is of opinion that far from endeavouring to facilitate the sale of skim milk, or at any rate legalising its sale by municipal or prefectorial orders, it would be preferable in the interests of public health and commercial morality not to modify the present situation in any way, experience having shown that the municipalities which have recourse to regulation of the sale of skim milk by municipal order, for the purpose of putting a stop to frauds by skimming, have only obtained the practical result of bringing about the almost complete disappearance of full cream milk;

Nevertheless, if it should be considered necessary for reasons of which the Society has no cognisance whatever, to resort to control, such control should be sufficiently severe and stringent to prevent a mother, in any case, and in any town of France, who might be unaware of the danger run by her child, being liable to have skim milk supplied to her in the place of natural milk.

# PLANT DISEASES

## GENERAL INFORMATION.



921 – **Decree of the Lieutenant-general of the King of Italy dated the 28th June 1916, No. 795, containing Measures for the Control of Field-voles in Apulia and adjacent Regions.** — *Gazzetta ufficiale del Regno d'Italia*, Year 1916, No. 158, pp. 3463-3464. Rome, July 6, 1916.

Art. 1. Antiphylloxera Associations (1) are bound to engage in field-vole control. For that purpose they are authorised to enter on their contribution lists all the owners of cultivated lands.

Art. 2. For communes which do not belong to an Antiphylloxera Association the Prefect will take the necessary measures, forming a compulsory Association for field-vole control, in pursuance of art. 38 of the regulations approved by decree of the Lieutenant-General dated March 12, 1916, No. 723 (2).

Art. 3. The State will contribute up to one half of the expenses entailed by the present decree ; it will advance the whole of the amount, and, for this purpose the sums appropriated in chapter 50 of the estimates of the Ministry of Agriculture for the financial year 1916-1917 will be increased by 600 000 lire.

The associations will be bound to refund one half of the amount of the expenses.

Art. 4. A Commissioner appointed by the Minister of Agriculture shall preside over the assessment of the expenses to be defrayed and their division between the State and the Associations.

Art. 5. In the estimates of receipts every year the share of expenses to be repaid by the Associations shall be entered, in accordance with art. 27 of the regulations approved by the decree of the Lieutenant General dated the 12th March 1916, No. 723, together with the interest provided in that article.

(1) See *B.* August 1913, No. 995, and *B.* January 1914, No. 71.

(2) These are the regulations for carrying into effect the law of the 26th June 1913, No. 888, which contains measures for the purpose of preventing and controlling plant diseases. See *B.* August 1913, No. 995.

The debt of the Associations will be secured in the manner provided in articles 28 and 29 of the regulations aforesaid.

Art. 6. No alteration can be made in the present administrative organisation of the Antiphylloxera Associations

## DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

922 — **Measures to prevent Injury by Frost in Catalonia, Spain.** — VIA RAVENTÓS JOSÉ, in *Resumen de Agricultura*, XXVIIIth Year, Part 2, pp. 68-80, Fig. 2. Barcelona, 1916

Observations on frosts and the best methods of preventing injury thereby in the vine-growing zone of the Lower Ebro. Under normal working conditions it is not always possible to make use of the instruments which allow of forecasting the arrival of cold waves a sufficient time beforehand as in meteorological Observatories. There is, it is true, a relation between the temperature at the moment of sunset and the minimum temperature which can be reached during the night, but this relation changes with the variations of the mistiness and hygroscopic conditions of the air, and the value of these factors varies, even in a short time, within very wide limits. On the other hand, observation and long practice enable vine-growers to foresee the arrival of frost with some approximation to the truth, but certainly not with all the desired accuracy where it is a question of combating low temperatures by smoke, a costly and troublesome method which of course should only be applied when really indispensable. Good results have been obtained with automatic alarms. Their cost is not excessive and they are easy to use. They consist of a RICHARD thermometer set up in the middle of the vineyard at a height of 20 to 25 cm and communicating with a bell, actuated by the current of three LABLANCHE cells, which rings when the temperature sinks to the danger limit : one fourth of a degree centigrade above zero. That is the time when the fires must be lit. An excellent kind of fuel for the purpose is creosote briquettes. They are placed in LESTOUT furnaces, or even in simple wooden boxes, slightly sunk into the ground and arranged round the vineyard at a distance of 26 feet apart. On burning them under these conditions for a period of 5 hours, the cost (including material, labour, etc.) is about 16*s*. per acre, which is far from being an excessive amount, as the injury which the frost would have produced in default of treatment must be taken into account. From a large number of observations and experiments the writer concludes that low temperature control in Catalonia is fully justified and remunerative. It would be much more so if the vine-growers were to form an association and create a special organisation for this purpose, with a system of well placed watch Stations.

923 – **Some Practical Means of Control of Wheat " Stretta ", in the South of Italy.** — MANCINI CAMILLO in *Il Coltivatore*, 62nd Year, No. 17, pp. 523-528. Casal Monferrat, June 20, 1916.

Wheat growing, extensively practised in the South of Italy, is very much checked by the disease called " stretta " of the wheat. This is a sort of sudden stoppage of growth accompanied by an almost certain drying when the wheat is in ear, and followed by unusual acceleration towards maturity, although the grain is not yet entirely full. The culm yellows early, and this yellowing afterwards spreads to the entire ear or a part only. The affected ear remains half empty and gives a smaller yield, because at the same time the grains are atrophied, small and light. " Stretta " usually occurs between the end of May and the beginning of June. The principal cause which gives rise to it is drought, and insufficient fertility of the soil is another cause. " Stretta " is more frequent in years with a hot and dry spring, and is more serious in too compact or too light soils, which, for opposite reasons, suffer more from the drought. On the other hand, " stretta " does not occur in wheat sown on beans or lupin ploughed in as green manures, or on broken-up meadow, lucerne, clover or sainfoin land.

From personal observations and experiments carried out during 40 years as an agriculturist, the writer advises the following means as being very effective against " stretta " and within the reach of all : 1) Deep tillage of the soil at the right time : very dry soils when deeply tilled during the summer did not suffer with " stretta ", while neighbouring soils tilled very superficially with the plough did not even yield an equivalent of the seed ; 2) thin sowing, both in rows and broadcast, accompanied by rational and sufficient manuring, so as to allow and induce tillering ; 3) cultivation work in autumn, winter and spring ; it is very useful to cultivate two or three times between the autumn and the beginning of spring.

924 – **Studies on the Amylase in Healthy Potatoes and in Those Suffering from " Leaf Curl ".** — *See* No. 851 of this *Bulletin*.

925 – **Diseases of Undetermined Origin in the Tomato, in Ontario.** — HOWITT J. E. and STONE R. E., in *Phytopathology*, Vol. 6, No. 3, pp. 162-166. Baltimore, Md., 1916.

In 1914 and 1915, tomatoes grown under glass were attacked by a disease the origin of which is still unknown, in several parts of Ontario. On the leaves, between the principal ribs, clearly outlined angular spots of a dark colour made their appearance, often combining and forming larger blotches. The infection involves not only the mesophyll but also the secondary ribs (more rarely the main ones) so that the bundles of vessels are coloured brown. The leaves attacked do not grow normally, and in time wither and fall.

The soft young leaves of the terminal branches are the first to be attacked, then the disease descends towards the base, where it also attacks the already grown leaves.

Here and there along the stems, without any specific localisation, oblong spots 1 to 3 cm. in length appear, only involving the most superficial tissue and rarely (in fact only in very severe cases) extending to the vascular bundles.

The diseased fruits exhibit hollow spots assuming different shapes, round or oblong, angular, with a diameter of 1 to 8-10 mm. In most instances the affection does not go beyond the surface of the fruit, but at times it penetrates to the centre, following the septum. The diseased parts do not colour and remain green and hard even during the ripening phase. When the disease is far advanced, the entire fruit remains discoloured and falls before it is ripe.

It was thought at first that the disease could be identified with the brown rot of the tomato, caused by *Bacillus Solanacearum* E. F. S., but a closer examination did not disclose the presence of any specific pathogenic germ. Attempts at artificial inoculation with infected tissue were entirely negative. Some growers attribute the characteristic affection of the leaves and fruits to the use of hydrocyanic acid fumigations, with which *Aleurodes* is controlled, but test experiments carried out to prove this gave negative results.

Experiments on sterilised soil seem to suggest the existence of a relation between the origin of the disease and the soil, but considering the absence of any pathogenic germ, it must be assumed that the disease is due to some chemical or physical defect of the soil, the action of which is to all appearance mitigated by sterilisation.

926 – **A New Infectious Mosaic Disease in the Cucumber, in America.** — Doolittle S. P., in *Phytopathology*, Vol. VI, No. 2, pp. 145-147. Baltimore, Md., 1916.

Experiments and tests in connection with a new " mosaic disease " observed in the cucumber, carried out by the Author in a field at the Station of Hamilton (Michigan), during the period 1914-1915. The first symptom of the disease is the appearance of black and yellow dappled spots between which the still green tissue stands out in distinct projections. If the infection develops, signs of growth cease, while on the leaves likewise a mosaic may be seen to appear, with dark green and light green spots. In the course of time, the diseased leaves wither and fall. On the shoots attacked, imperfect buds develop with dappled foliage ; the flowers are few and the number of fruits set is still fewer.

The result of the experiments may be summed up as follows : 1) although it has not yet been possible to isolate the specific pathogenic agent, as the disease spreads very rapidly it obviously is a very virulent disease of highly infectious character ; 2) if infected matter is inoculated into healthy cucumbers, the characteristic symptoms generally appear within a period of 18 to 20 days, while all the control plants remain healthy ; experiments of this kind, with hypodermic injections of sap extracted from the diseased tissues, were carried out in several places in 1914 and 1915, always followed by a clearly positive result ; 3) artificial infections are also obtained by tearing off the leaves of a healthy plant and touching the wound with the broken leaf-stalk of a diseased plant ; 4) The fresh expressed juice of diseased plants as well as that from diseased fruits inoculated into a healthy cucumber plant, also produced the disease ; 5) infected extract retains its virulence even if passed through the Berkefeld filter ; 6) aphids contribute

largely to the spread and extension of the disease, as is evident from the experiments carried out with *Aphis gossypii* Glover (" melon aphid ").

927 – **Mosaic Disease in Cucumbers grown under Glass.** — JAGGER J. C., in *Phytopathology*, Vol. 6, No. 2, pp. 148-151. Baltimore, Md., 1916.

The symptoms of the mosaic disease in plants grown under glass are identical with those found in plants growing in the field. With regard to the effects, on the other hand, they are much worse, which fact is no doubt explained by the lower degree of resistance of plants which have developed in an artificial and enclosed environment. A few days after the appearance of the first symptoms the branches wither and die, and sometimes the whole plant dries up. Tests of artificial infection have been made by inoculating varying quantities of sap taken from infected plants into the stalk of healthy cucumbers with a hypodermic syringe. The result was invariably positive. *Aphis gossypii* Glover contributes largely to the spread of the disease, as was shown by numerous experiments carried out by the writer in the vicinity of Rochester, New York. The infected sap of diseased cucumbers inoculated into plants of *Cucurbita* brought about the onset of the disease. Furthermore the plants thus contaminated, in their turn furnished material which produced the same disease in other healthy cucumber plants.

928 – **Sour Scab of Citrus Plants in Florida.** — GROSSENBACHER J. G., in *Phytopathology*, Vol. 6, No. 2, pp. 127-142. Fig. 4. Baltimore, Md., 1916.

The name of " sour scab " is applied to a disease of the leaves, branches and fruits of certain varieties of *Citrus* having a strongly acid sap in their actively growing portions.

*Citrus Aurantium* var. *amara* (sour orange), *C. medica* var. *Lemon* (lemon) and *C. medica* var. *genuina* (citron) are very susceptible to the disease, and the same applies to almost all the commercial varieties of *C. decumana* var. *Pomelo* (grapefruit), except perhaps " Triumph " which appears to be a resistant variety.

The most evident pathological symptoms are the distorted appearance of the leaves and the warty, misshapen fruits. Both on the leaves and on badly diseased fruits, conical elevations with greyish brown tips are found. Some parts of the leaf seem to grow faster than others, which causes the characteristic distortion. As the season advances, the warty protuberances flatten out slightly and become scabby. Finally, if the weather keeps sufficiently hot and moist, *Cladosporium Citri* develops at the infected spots and produces an enormous quantity of brownish-black spores.

The severity of the attack varies greatly from year to year and often from tree to tree. Generally this disease is more frequent in the hot and moist seaboard region than in the pine region, which is more inland and at a greater altitude, where plant growth is slower.

On the other hand, when the weather is cold and wet at the beginning of spring this disease appears even in groves in high-pine land, especially if there has been an excessive use of nitrogenous manure.

Good results may be obtained, however by individual selection of very

late types which might be capable of displacing the phase of maximum receptivity, that is to say, the moment when growth is most rapid and most intense, to a point far ahead in the season, so as to make this phase coincide with a more favourable weather period. The Marsh seedless variety would be well adapted for this purpose. The quality of the host on which *C. decumana* var. *Pomelo* has been grafted also influences the development of the disease. The disease is more frequent in plants grafted on the wild lemon tree than in those grafted on the bitter orange (*C. Aurantium* var. *amara*), which are not so early.

The injury caused every year by this disease to the crop of *C. decumana* var. *Pomelo* in Florida totals $ 50.000, and still greater injury is reported at Cuba, Porto-Rico and the Pine islands.

It is obvious from the foregoing that humidity is one of the most important factors in the development of the disease. When the small leaves begin to open, during the phase of rapid growth of the leaf, numerous small drops of dew form on both surfaces of the leaf during the night, the quantity varying according to the relative humidity of the air. If the latter remains near the dew point, the droplets combine to form one continuous layer of water, which covers the underside of the leaf for several days at a time. If on the other hand the air becomes very dry, the water which has accumulated during the night evaporates during the early hours of the day.

The moisture of the air and the presence of a water film on the leaves form very favourable conditions for the development of the disease. What is the deduction to be made from these circumstances with respect to the origin of the disease ?

It is a well known fact that the acidity of citrus fruits becomes more pronounced in proportion as the humidity of the atmosphere increases and the temperature is lowered. Therefore the question at once suggests itself whether there is not a relation of cause and effect between the development of the disease and excessive acidity due to the wet and cold weather.

| Localities | Materials used | Number of trees Counted | Total Number of fruits | Healthy fruits | | Scabby fruits | |
|---|---|---|---|---|---|---|---|
| | | | | Number | % | Number | % |
| Orlando | Bordeaux mixture. . . | 5 | 1281 | 887 | 69 1/3 | 394 | 30 2/3 |
| » | No treatment. . . . . | 4 | 1262 | 6 | 1/2 | 1256 | 99 1/2 |
| » | Lime-Sulphur. . . . . | 9 | 2371 | 542 | 22 4/5 | 1829 | 77 1/5 |
| Bradentown | Bordeaux mixture. . . | 2 | 628 | 587 | 93 1/2 | 41 | 6 1/2 |
| » | No treatment. . . . . | 4 | 597 | 88 | 14 1/2 | 509 | 85 1/2 |
| » | Lime-Sulphur. . . . . | 4 | 1024 | 527 | 51 1/2 | 497 | 48 1/2 |
| » | Soluble sulphur (polysulphide of sodium) . | 4 | 843 | 454 | 53 1/2 | 389 | 46 1/2 |

During their phase of maximum growth, those varieties of *Citrus* which are most subject to the disease emit a strong aroma suggestive of acid. Under normal conditions it is volatilised, but when the leaf is covered with a thin layer of water, it enters into solution and is concentrated to such an extent as to attack the most superficial tissue.

Furthermore, the presence of water on the leaves promotes the growth of the glands. When the latter grow to an excessive extent, their walls are thinned and they often break, the contents being emptied on to the leaves and the rind of the fruit. The edges of these glands afterwards grow to such an extent as to form a crater-shaped hollow, in which the remains of the epidermal cells are found. When on the other hand the growth of the leaf in area predominates, the original injury due to breaking of the gland extends, and exhibits the characteristics of the disease.

The writer has been unable to establish definitely the chemical composition of the glandular content of *C. decumana* var. *Pomelo*. Nevertheless, it is known that the main constituents of orange oil, such as limonene, anthranilic acid and anthranilate of methyl, when applied to the leaves or fruits by means of a sprayer cause serious injuries.

The excessive growth of the oil glands, the injuries due to their bursting, the emergence and accumulation of their contents on the leaves and on the fruits, all of them phenomena which are facilitated by wet weather and cold, appear to be clearly connected with the origin and development of the disease.

The opinion obtaining hitherto, acording to which *Cladosporium Citri* was the specific pathogenic agent, cannot hold good in view of the negative results obtained by the writer during a lengthy series of experiments. On small plants disinfected with bichloride of mercury at a strength of 1 ‰ and growing under conditions precluding all possible infection, the disease developed, and on the other hand it was not found possible in any case to cause it by inoculating spores of *Clodosporium* into the tissues of healthy plants.

Various experiments in connection with the application of remedies were carried out in two localities : at Orlando and Bradentown. The results are summarised up in the appended table.

It is advised to apply Bordeaux mixture at the height of the flowering period, following it, after an interval of 8 or 10 days, with an application of lime - sulphur solution and, three weeks later, with a second treatment, again with lime sulphur solution.

## DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

### GENERALITIES.

929 – **Contributions to the Study of the Mycology of Liguria, Italy.** — MAFFEI LUIGI in *Atti del R. Istituto botanico dell'Università di Pavia*. IInd Series, Vol. XVI, pp. 225-243. Pl. XVII. Milan, 1916.

In this fourth contribution to the study of Ligurian mycology, the writer gives a systematic list of 141 species of fungi of which 85 are recorded for the first time in Liguria.

Among the species determinied and studied by the writer, there are included some already recorded by others during the last few years, and which have been mentioned here in order to facilitate future research into Ligurian mycology.

In addition to the descriptions already recorded (1), the writer figures four species new to science.

The species: *Anthostomella Molleriana* Trav. and Spessa living on the leaf-stalks of *Phoenix canariensis*; *Ascochyta Spiraeae* Kab. and Bub., on the leaves of *Spiraea* sp; *Myxosporium Balmoreanum* Speg. on the rachis of withered leaves of *Kentia* sp.; *Alternaria Dianthi* Stev. et Hall, on *Dianthus*, and some others again are new to Liguria and also to the Italian mycological flora.

The Writer makes critical observations in reference to several species: *Macrophoma calaritana* (Br. et Cav.) Maffei, living on the leaves of *Ceratonia Siliquea; M. Dracaenae-fragrantis* Mori, on the leaves of *Dracaena indivisa* etc.

To the bibliography previously given, 17 other works are now added.

930 – ***Phomopsis diploglottidis, Ph. briosii, Coniothyrium hypoglossi* and *Ceuthospora pollaccii*, new Micromycetes discovered in Italy.** — Mutto Elisa., in *Atti del R. Istituto botanico dell'Università di Pavia*, IInd Series, Vol. XVI, pp. 205-207. Pl. XV. Milan, 1916.

A description of the following new species of micromycetes discovered in the Botanical Garden of the Royal University of Pavia:

1) *Phomopsis diploglottidis* n. sp., causing the appearance of spots at the tip and on the edges of the leaves of *Diploglottis Cunninghamii*;

2) *Ph. Briosii* n. sp., the presence of which produces the formation of spots which encroach on the leaves and leaf-stalks of *Roupala nitida*;

3) *Coniothyrium Hypoglossi* n. sp., which causes spots on the cladodes of *Ruscus Hypoglossum;*

4) *Ceuthospora Pollaccii* n. sp. which grew on a stem of *Chamaedorea elegans.*

931 – **Diseases and Enemies of *Diospyros virginiana* in the United States.** — See No. 872 in this *Bulletin.*

932 – **The Part played by Insects in the Spread of *Bacillus amylovorus*** — Stewart V. B. and Leonard M. D., in *Phytopathology*, Vol. 6, No. 2, pp. 152-158. Baltimore, Md., 1916.

Experiments with a view to ascertaining whether sucking insects are capable of spreading and inoculating into healthy plants the *Bacillus amylavorus* (Burr.) Trev., with which they may easily become infested when settling on diseased trees.

In the course of these experiments young pear and apple plants were used, enclosed in wire gauze cages. There was spread in abundance on some of these plants (2 or 3 per cage) a culture of *B. amylovorus* in agar. Afterwards, some specimens of the following insects were introduced into each

(1) See *B.* June 1916, No. 701. (*Ed.*)

cage : *Pollenia rudis* Fabricius ; *Empoasca mali* Le Baron ; *Psylla pyricola* Förster ; *Plagiognathus politus* Uhler and *Sapromyza bispina* Loew.

Although the insects were entirely at liberty to go from one plant to the other, the disease was unable in any case to spread from the infected to the healthy plants. This is probably due to the fact that sucking insects are not able to produce lesions of the tissues such as would facilitate penetration of the *Bacillus*.

There are insects which are much more active in this direction, although fairly few in number ; they are : false tarnished plant bug (*Lygus invitus* Say) ; and the apple red bugs (*Heterocordylus malinus* Reuter and *Lygidea mendax* Reuter). The possibility of the bacilli penetrating into the plant through the lesions caused by these insects cannot be dismissed.

933 – **On the Susceptibility of *Phaseolus vulgaris* and *P. multiflorus* to Bean Rust *(Uromyces appendiculatus)* and other Fungoid Diseases.** — LAKON GEORG., in *Zeitschrift für Pflanzenkrankheiten*, Vol. 26, No. 2, pp. 83-97, Stuttgart, 1916. RESISTANT PLANTS

Mycological literature indicates no specific differences between *Phaseolus vulgaris* and *Phaseolus multiflorus* as regards their susceptibility to bean rust. The experiments of the present writer however show that such specific differences do exist. He studied several kinds of beans belonging to these two species, which are grown in his garden, where rust was very prevalent the year before, The plants affected were: 3 varieties of *P. multiflorus*, 3 climbing varieties of *P. vulgaris* and one variety of *P. vulgaris nanus* ; they were so near to each other that the possibility of infection was the same for all the plants.

At the end of the summer when the fungus appeared in consequence of the intense formation of teleutospores, a difference was observed in the susceptibility of the different plants. It was noted that the plants were either strongly attacked by the parasite or else free from fungi. This phenomenon was first of all put down to characteristics inherent in the varieties. More thorough studies showed indeed that *P. vulgaris* was alone attacked, while *P. multiflorus* was quite free. The difference was so great that later on it was possible to distinguish one species from the other merely by the presence or absence of the parasite ; these results were also confirmed by subsequent botanical examination.

These observations were completed with the aid of more abundant material. A large number of kitchen-garden plants at Hohenheim and environs were first of all studied, and it was found that *Phaseolus multiflorus* was exempt, while *P. vulgaris* was always strongly attacked. Attention was next given to a large number of varieties of beans grown in the Botanical Garden of Hohenheim, namely : 7 different kinds of *P. multiflorus ;* 37 different varieties of the climbing form of *P. vulgaris* and 24 different kinds of *P. vulgaris nanus*. A minute study of each of the leaves of all these specimens disclosed the following facts :

1) all the specimens of climbing forms of *P . vulgaris* were strongly attacked and covered with teleutospores of the fungus ;

2) Among the 24 varieties of *P. vulgaris nanus*, 8 had all specimens strongly attacked and 13 had all their individuals free ;

3) All the individuals of the 7 kinds of *P. multiflorus* studied were exempt, with the exception of 2 belonging to 2 different kinds, in which the Author was each time able to find a single leaf slightly attacked.

Therefore these results confirm those obtained in the preceding researches, and it is concluded consequently that *P. multiflorus* is practically resistant to bean rust. Cases nevertheless occur where this species is likewise attacked by *Uromyces*, but they are so rare as to be without importance in practical phytopathology.

These experiments proved that there are differences in regard to rust-resistant powers not only between *P. vulgaris* and *P. multiflorus*, but also between the different varieties of *P. vulgaris*. Consequently the resistance of the different kinds should be determined by cultivation experiments continued over several years. In the literature unfortunately little information is given on this point.

It was not possible to determine the cause of the immunity of *P. multiflorus*. It is well known that rust appears most frequently at the end of summer, that is, at a time when the plant is already partly exhausted. It was concluded from this fact, that resistance to rust is connected with the time at which the exhaustion of the plant takes place. This hypothesis appeared particularly plausible when it was considered that *P. multiflorus* lives longer than *P. vulgaris*. Closer examination however demonstrated that this assumption is without foundation. It was shown that plants of *P. vulgaris* which, owing to their very late plantation, were still in full vigour and provided with young fresh foliage at the end of summer, already contracted rust at this stage of development. Nevertheless, this question should be still further studied by experiments in which the time of exhaustion is accelerated by artificial means.

*Phaseolus multiflorus* not only resists rust better than *P. vulgaris* but is also more resistant to other diseases, above all bean anthracnosis which appears on the pods and is caused by *Gloeosporium Lindemuthianum* Sacc. and Magn. *P. multiflorus* therefore represents a species highly resistant to certain fungal diseases. It therefore deserves to be more extensively grown, the more so as the seed it produces is very good.

934 – **The Selection of Types of Tobacco Resistant to *Thielavia basicola*, in America.** — Johnson James, in *Phytopathology*, Vol. 6, No. 2, pp. 167-181. Fig. 6. Baltimore, Md., 1916.

Root rot in tobacco is caused by the fungus *Thielavia basicola* Zopf, which attacks the roots only. Affected plants are characteristically stunted and thus the yield is considerably reduced. Complete destruction of the plant is rare.

The disease remained unknown for a long time, and to the present day it escapes notice in many cases, because the symptoms accompanying it (retarded growth, yellowing of the lower leaves) are in the majority of cases attributed to the advancement of the season or the unfavourable chemical or physical properties of the soil.

All kinds of tobacco are not equally liable to contract the disease (see Table page 1201).

| Varieties | Green weight of 25 plants | | Relative resistance |
|---|---|---|---|
| | in uninfected soil | in infected soil | |
| | lbs | lbs | per cent |
| « White Burley » | 66.5 | 3.0 | 4.5 |
| « Comstock Spanish » | 59.5 | 20.0 | 33,6 |
| « Connecticut Havana » | 45.0 | 20.75 | 46.1 |
| « Kentucky Greenleaf » | 49.75 | 3.0 | 6.0 |
| « Pennsylvania Broadleaf » | 82.5 | 14.0 | 16.9 |
| « Brasile Beneventano » | 56.6 | 41.25 | 73.0 |
| « Maryland Broadleaf » | 65.0 | 2.5 | 3.8 |
| « Italia Kentucky » | 60.0 | 39.5 | 65.8 |
| « Big Oronoco » | 57,75 | 3.0 | 5.2 |
| « Ohio Seedleaf » | 70.5 | 15.25 | 21.6 |
| « Yellow Pryor » | 59.0 | 2.5 | 4.2 |
| « Black Seedleaf » | 84.25 | 23,25 | 27.6 |
| « Halladay Havana » | 58.5 | 33.25 | 56.8 |
| « Gregory's White Burley » | 59.75 | 1.75 | 2.9 |
| « Little Dutch » | 79.50 | 40.0 | 50.3 |
| « Montgomery Seedleaf » | 93.50 | 44.0 | 47.0 |
| « Maryland Narrowleaf » | 66.50 | 2.25 | 3.3 |
| « Cuban » | 28.25 | 5.25 | 18.5 |
| « Northern Hybrid » | 65.0 | 45.5 | 70.0 |
| « Golden Spanish » | 50.0 | 25.5 | 51.0 |
| « Silver Leaf » | 56.25 | 31.5 | 56.0 |
| « Page's Comstock » | 41.25 | 32.5 | 78.7 |
| « Pease Seed » | 49.0 | 37.25 | 76.0 |

An examination of the table shows clearly that the degree of resistance varies considerably from one type to the other, but unfortunately the most resistant types are also the least used and least appreciated, while the varieties most sought after, "White Burley", "Comstock Spanish" and "Connecticut Havana" are extensively injured by the fungus. In the present article there are set out the results of a series of researches and experiments undertaken with the object of selection from among the best varieties susceptible to the disease the small number of individuals offering some resistance, and which might serve as the basis for a renewal of the seeds.

After having explored a considerable area of plantations, at the Agricultural test Station of Madison, Wisconsin, and at Walker Son's Farms at Walkerville, Ontario, Canada, there were isolated 45 plants of the type "White Burley" and 42 cigar leaf types ("Comstock Spanish", etc.) They

are clearly distinguished from the others by their high degree of resistance to the attacks of *Thielavia basicola*. These plants were covered with hoods to ensure self-pollenation ; they were numbered and noted, and the seeds of each of them were sown separately on special plots.

Type " White Burley ". — The experiments relating to this were undertaken at Ontario. On the plantations of " White Burley, " " mongrels " or " Green Burley " specimens are sometimes met with, which are distinguished by the decided green colour of their leaf-stalks and ribs, which, on the other hand, are whitish in colour in normal plants. The green plants resist the disease better than the others. Some of them being isolated and reproduced in pure lines, were found to be resistant and true to type, while others split up into green and white. It was possible to isolate from the latter, resistant types such as " B 1193 ", the resistance of which in infected soil may exceed one hundred times that of the common " Burey " (relative resistance 42.6 and 0.5 respectively) and " P 701 B " which is not yet fixed, but already promises well.

" Cigar Binder Leaf " Type. — The experiments in relation to this were conducted at Madison. The best types " Comstock Spanish " and " Connecticut Havana " are going more and more out of favour with planters and are replaced by types resistant to *Thielavia*, such as Seedleaf ", " Big Seed ", "Hybrid " (as representatives of these latter types see table ; " Page's Comstock ", " Pease Seed " and " Northern Hybrid " which nevertheless give a product somewhat inferior in quality).

In the plantations of Wisconsin, as already stated, 45 specimens were isolated, the progeny of which were studied and tested during the period 1913-1915. The data collected cannot be used for instituting comparisons, because the infected soil was so fertile that it yielded a crop in excess of that of the sterilised soil. They at any rate show the possibility of obtaining by individual selection, superior types having at the same time a high degree of resistance.

935 – **Resistance of *Pyrus calleryana* to Necrosis of the Bark and Branches (*Bacillus amylovorus*).** — See No. 870 in this Bulletin.

936 – **Studies on the Resistance of *Prunus* spp. to *Bacterium tumefaciens*.** — Smith O. Clayton., in *Phytopathology*, Vol. 6, No. 2, pp. 186-194, Pl. VI. Baltimore, Md., 1916.

Experiments were undertaken with a view to studying the degree of resistance to *Bacterium tumefaciens* in the different species and varieties of fruit trees of the genus *Prunus*. This bacterium is, as was proved by the researches of Erwin F. Smith, the primary cause of the hypertrophied formations on the branches and twigs, which are known under the name of " crown gall " (1).

All the species of *Pruuns* are not equally liable to contract this disease, and it must not be considered impossible to find and fix practically immune types which might serve as a basis for a progressive renewal of the orchard,

(1) See *B.* Feb. 1913. No. 185. (*Ed.*).

| Species | Variety or origin | Number of inoculations | Infections | % of infections compared to inoculations | Size of galls mm |
|---|---|---|---|---|---|
| *P. pumila* | 2 varieties | 110 | 0 | 0 | |
| *P. domestica* | « Italian prune » | 140 | 10 | 7 | 1.5– 3 |
| *P. cerasifera* | *P. planteriensis* | 40 | 3 | 7 1/2 | 1.5– 2 |
| *P. domestica* | « German prune » | 240 | 24 | 10 | 1.5–12 |
| *P. insititia* | « Damson » | 120 | 13 | 10 | 3 –12.5 |
| *P. Besseyi* | | 50 | 5 | 10 | 3 –12.5 |
| *P. hortulana* | « Golden Beauty » | 110 | 25 | 22 | 1.5– 3 |
| *P. Amygdalus* | « Bitter Almond » | 100 | 22 | 25 | 3 – 9 |
| *P. domestica* | « Reine Claude » | 90 | 25 | 26 | 1.5–12.5 |
| *P. Armeniaca* | « Mikado » | 40 | 11 | 27 | 1.5– 4.5 |
| *P. angustifolia* | *P. Watsoni* | 50 | 15 | 30 | 1.5– 3 |
| *P. maritima* | « Arnold Arboretum » | 140 | 48 | 34 | 1.5– 3 |
| *P. dasycarpa* | » » | 130 | 55 | 42 | 1.5–12.5 |
| *P. mitis* | » » | 60 | 32 | 53 | 1.5– 3 |
| *P. cerasifera* | » » | 110 | 70 | 63 | 1.5– 6 |
| *P. Munsoniana* | » » | 70 | 48 | 68 | 3 – 4.5 |
| *P. Munsoniana* | Arkansas | 90 | 70 | 77 | 1.5– 9 |
| *P. americana* | « Arnold Arboretum » | 100 | 83 | 83 | 1.5–12.5 |
| *P. hortulana* | » » | 130 | 108 | 83 | 3 –18 |
| *P. insititia* | *P. pendula* | 90 | 77 | 85 | 1.5–18 |
| *P. Davidiana* | | 110 | 96 | 88 | 1.5–18 |
| *P. triflora* | « Burbank » | 120 | 109 | 90 | 12.5–37.5 |
| *P. nigra* | « Arnold Arboretum » | 60 | 56 | 90 | 6 – 9 |
| *P. orthosepala* | » » | 80 | 72 | 90 | 1.5– 3 |
| *P. Mume* | » » | 100 | 91 | 91 | 6 –12.5 |
| *P. Munsoniana* | « Pits Arnolds » | 140 | 130 | 92 | 1.5–37.5 |
| *P. cerasifera* | *P. divaricata* | 100 | 94 | 94 | 3 –18 |
| *P. Persica* | « Elberta » | 130 | 122 | 94 | 6 –18 |
| *P. Armeniaca* | « Royal Apricot » | 120 | 117 | 97 | 6 –25 |
| *P. triflora* | « Arnold Arboretum » | 140 | 137 | 97 | 3 –18 |
| *P. Munsoniana* | El Paso | 100 | 97 | 97 | 6 –12.5 |
| *P. cerasifera* | (shoots and slips) | 120 | 117 | 97 | 6 –37.5 |
| *P. triflora* × *P. Simonii* | | 140 | 138 | 98 | 1.5–18 |
| *P. cerasifera* | (one tree) | 150 | 150 | 100 | 6 –37.5 |
| *P. monticola* | Experim. Stat. of Arizona | 40 | 40 | 100 | 12.5–37.5 |
| *P. Simonii* | « Arnold Arboretum » | 130 | 130 | 100 | 6 –37.5 |

which has now become necessary : 1) owing to the increasing spread of this disease and the extensive damage it occasions : 2) owing to the impossibility of detecting young plants with incipient disease before planting : 3) owing to the persistance of the germs in the soil, which germs later on attack the healthy plants.

The plan adopted in order to determine the degree of resistance to *Bacterium tumefaciens* is to inoculate pure cultures (in standard agar with the addition of 0.5 % of dextrose), at one week's interval, from May till September for the purpose of testing the plant in all phases of growth.

Three lots of bacteria were used : " No. 694 " isolated from infected young peach plants ; " No. 753 " from the galls of an almond tree (14th April 1913); and " No. 790 " isolated from an adult peach tree.

The species and varieties of *Prunus* examined were the following : *P. alleghaniensis ; P. americana ; P. Amygdalus ; P. Andersoni ; P. Armeniaca ;P. Armeniaca* var. *Mikado ; P. avium ; P. Besseyi ; P. caroliniana ; P. cerasifera* var. *planteriensis ;* different varieties and various types of *P. domestica ; P. eriogyna ; P. glandulosa ; P. hortulana ; P. ilicifolia ; P. integrifolia ; P. Mume ; P. Munsoniana ; P. nigra ; P. orthosepala ; P. pennsylvanica ; P. Persica ; P. platicarpa ; P. pumila ; P. serotina , P. Simonii* and *P. Watsoni.*

The various degrees of susceptibility are measured by means of the frequency of infestation and the size of the galls, which vary from 5 cm. in diameter to such small dimensions that it is difficult to distinguish them from the surrounding tissue.

In the appended table are found the data arranged in comparative form. For *P. ilicifolia, P. caroliniana* and *P. Amygdalus,* a complete series of observations are wanting. Nevertheless these experiments show that the first two species are highly resistant, almost immune. On the other hand, *P. amygdalus* is highely susceptible.

Of the resistant species therefore the best would be *P. pumila* and the two varieties " Italian prune " and " German prune " of *P. domestica.* Nevertheless *P. pumila* is not adapted for re-stocking owing to its tendency to dwarf the varieties grafted on it. On the other hand, such good results were obtained with the two above varieties of *P. domestica* that it would be advisable to continue experiments in this direction, so as to isolate in the *domestica* group practically immune varieties or types, the possibility of existence of which must not be precluded. *P. hortulana* is considered by many fruit-growers as destined to yield good results specially in the indigenous varieties. The resistance to *Bact. tumefaciens,* is however not considerable, except in the variety " Golden Beauty ". In the " Damson " group *P. institutia,* known under the name of *P. pendula,* is rather susceptible ; the other kinds, on the contrary, present a high degree of resistance and are certainly capable of supplying good material for further work.

For the peach tree (*P. Persica*), conclusive data are not available. Nevertheless the varieties " Elberta ", " Saucer " or " Peento ", " Salway ", " Lovell " and " Muir " seedlings hitherto examined, did not show resistance.

Fourteen kinds of almond trees (young plants growing at Davis, Cali-

fornia, on the University Farm, were inoculated in 1916, and in all there was an abundant formation of galls. The same results were obtained with *P. Armeniaca, P. Armeniaca* var. *Mikado, P. Mume* and *P. mandschurica.*

The major part of the varieties and kinds at present preferred in California as basal material for orchards are therefore, in principle, highly liable to contract crown gall; on the other hand, there are types, little known as yet, belonging to different groups and especially to the species *P. domestica* which, if duly controlled and selected, may furnish an excellent renewal stock.

MEANS OF PREVENTION AND CONTROL

937 – **Prophylaxis in Vegetable Pathology.** — Comes Orazio, in *Reale Istituto d'Incoraggiamento di Napoli*, 173 pp. Naples, 1916.

The writer points out that though it is still absolutely necessary to resort to therapeutic means whenever the plant is ailing or attacked by parasites, it would be desirable, on the other hand, to take into account what has long been practised in animal pathology. In animals, the extension of the action of hygiene limits the sphere of therapeutics in a greater degree day by day, and in the same way, by more rational attention and more appropriate measures, the cultivated plant must be made stronger, and more capable of resisting the attacks of its enemies; in other words, greater attention must be devoted to the hygiene of the plant.

Yet it must not be forgotten that sensitiveness to bad weather and receptivity to parasites vary in plants with age, methods of cultivation, and the environment in which they are grown. Furthermore, ordinary practice shows that the resistance to adverse agencies varies in cultivated plants with the different races, and, in the same race, with the individual. It follows that on the whole, the resistance is rather individual than specific. In view also of the remarkable influence of the environment and methods of cultivation on the plant, it must be expected that this influence will be clearly reflected in the capacity of resistance of the plant, even if the latter be modified so as to render receptive plants considered as immune, and also to cause fungi considered as inoffensive or at least as semi-parasitic to become injurious.

On the other hand, from the biological point of view, it cannot be maintained that there are absolutely immune races; nevertheless, such steps may be taken as to ensure that their resistance to adverse factors should not be reduced so as to jeopardise their productivity. This object might be obtained by hygiene and prophylaxis. The latter alone could little by little lead to the abolition of the empirical methods which still predominate; by guiding vegetable pathology once for all along a rational path, it will result in rendering intensive agriculture more economical, in spite of the evergrowing delicacy of its products.

Such is the theory maintained by the writer, and the object of his article. He reviews an extensive series of observations and researches collected from the literature on the subject.

His work is divided into two parts; in the first he deals with plant susceptibility to disease, and in the second with resistance.

As regards the susceptibility, the influence of the climate, soil, cultiva-

tion methods, and nitrogenous manure are dealt with in particular. The conclusions are as follows :

*Climate.* — 1) A plant cultivated in a climate differing from that of its origin, retains and may even increase its resistance to adverse agencies if introduced into a colder climate ; on the contrary, it loses this resistance in an ever greater degree if introduced into a hotter climate.

2) The necessity of adapting itself to the new climate, even if the difference from that of origin is small, produces variation in the physiological processes of the imported plant ; it inevitably entails a greater variation in the quantity than in the quality of the organic substances it produces, and consequently of those also which furnish the plant with the necessary means for resisting the attacks of its enemies.

3) The variations in the cell sap produced by a colder or a hotter environment are reproduced in analogous fashion in plants cultivated with a colder (northern) exposure or hotter (southern) exposure respectively.

4) These variations form a local problem as regards the selection of the most resistant varieties.

5) The plants imported into hotter and moister, and into wetter localities always become more sentitive to disease, and in particular to the attacks of parasitic micromycetes. The same is the case in exclusively rainy years during the growth of the plant.

6) Repeated and conclusive examples exist of the fact that plants imported into hotter climates than those of their origin gradually lose their original resistance to adverse factors, as in the case of wheat with regard to rusts, the vine with regard to oidium, mildew and phylloxera, and generally, kitchen garden and fruit plants in relation to their respective parasites.

7) Comparisons between the behaviour of plants in different climates can only have a conclusive value in those cases where all the conditions of cultivation of the several plants are alike ; otherwise, the conclusions will be false or at any rate arbitrary.

*Soil.* — 1) The soil water having even a slightly acid reaction more effectively facilitates the growth of the plants cultivated therein.

2) Soils with an alkaline reaction, on the contrary, facilitate the phenomena of drying up of the leaves in oats, of scurf in the potato, or " foot-rot " in wheat, chlorosis in American vines, and so on.

3) Limestone soils cause a greater production of sugar in plants, and at the same time are an obstacle to the presence of free organic acids.

4) The addition of alkaline substances to the soil renders plants more sensitive to injurious external influences ; acid fertilisers and manures have a contrary effect.

5) The resistance of plants to adverse factors is greater in loose soils and less in compact soils.

6) Stagnant subsoil waters, owing to their gradual impoverishment in dissolved oxygen, cause asphyxia of the roots, which is followed by necrosis of the tissues, and afterwards by the appearance of mycelia (rhizomorphs, *Rhizoctonia*, etc.).

7) The hardiness of wild plants is due not only to the greater den-

sity of their tissues in consequence of the shortage of available nitrogenous substances in the compact soil, but also, and in a still greater degree, to the acidity of their cell juices, owing to the incomplete combustion of the carbohydrates chiefly contained in the roots, the air circulation being difficult and sometimes interrupted in compact and uncultivated soil.

*Cultivation.* — 1) By cultivation man has rendered edible the organs of wild plants which are to-day replaced by their cultivated varieties.

2) Assiduous, intense and even forced cultivation results in inducing an enlargement of the organs of the wild plant, and also renders them succulent in consequence of the increase of volume in the anatomic elements as compared with the cellular tissue, as well as by the continually greater diminution of their walls, until the elements of the sclerenchyma are seen almost to disappear.

3) By progress in the improvement of a plant, its sensitiveness to adverse causes is also increased.

4) The development of a parasitic infection is always related to the medium (environment in which it develops) which is offered by the tissues of the plants attacked ; the result is that, all other conditions being equal, the infection increases with the improvement gained by the plant.

5) Conversely, for fruit plants, seed reproduction habitually produces a retrogression in the improvement obtained ; the same retrogression is brought about by the absence of cultivation ; the products, which in both cases are marred in quality, certainly run less risk of disease than similar plants, but improved.

*Nitrogenous Manure.* — 1) Manuring with suitable manure renders the tissues more juicy and consequently more sensitive to bad weather ; they are also richer in sugar, and consequently more attractive to animal and vegetable parasites.

2) The richer a soil is in nitrogen, the shorter the period of time elapsing between inoculation and infection with a vegetable parasite ; there is also an increase in the receptivity of cultivated plants to parasites of every kind. An abundant nitrogenous manure, in whatever form given, always produces the same effects.

3) Nitrate of soda, which calls forth greater productivity of the plant, on the other hand renders it much more tender, and consequently more sensitive to the bad effects of adverse factors.

4) Excessive nitrogenous manure prolongs the growing period of plants and retards lignification ; consequently the foliage will be more sensitive to winter cold, with a loss in the new production and risk of loss of sap and gum.

In the 2nd part of the work on plant resistance to disease, the writer examines the following questions in succession : the resistance of the plant organs; the chemistry of the tissues; the acidity of the sap and oxydases ; the acidity of the sap and plant parasites; the acidity of the sap and animal parasites ; tannic substances and parasites ; selection crossing and high grafting ; manures.

The conclusions are as follows :

*Resistance of the Organs.* — 1) The organs of wild plants have more compact, i. e. less watery, tissues, and more acid, *i. e.* less sweet, juice than the organs of the corresponding plants of cultivated species.

2) More resistance is offered : (*a*) to rusts, by the varieties of wheat with narrower and more waxy leaves (yellowish in colour), such as those in the hottest and driest regions ; (*b*) to smuts, by those varieties of wheat which are bearded, the loss of the beard being a sign of improvement ; (*c*) to lodging, by those varieties of wheat which, like the Noè, have the solid part of the culm more fully developed ; (*d*) to diseases, by those varieties of potato which have hardy and straight stalks, leaves small and downy, and the tubers covered with a coarse skin ; (*e*) to diseases, by those varieties of olive tree which have smaller olives and a less developed mesocarp together with a more compact wood : (*f*) to diseases, by citrus plants obtained by sowing rather than those obtained by non-sexual reproduction ; (*g*) to diseases in general, by those plants which present morphological characters similar to those of hot and dry regions, non-fatty xerophytic plants.

*Chemiotaxy of the Tissues.* — 1) Whilst the resistance is different in the different races or varieties of the same species bred under like conditions, no characteristic anatomical difference was found in their tissues by which the different resistance to diseases could be explained.

2) Any variation in the environment or in the methods of cultivation produces a modification in the strength of resistance, so as to render susceptible even those races which had previously been regarded as refractory.

3) Both resistance and susceptibility are individual and inherent characters rather than race characters.

4) The substance endowed with positive chemiotropism is formed by the sugars and starches, but more particularly by the former than by the latter.

*Acidity of Sap and Oxydases.* — 1) in a given organ, other conditions being equal, the receptivity to parasites increases with the quantity of reducing sugars ; and on the other hand, resistance increases with the organic acids.

2) In the cell sap the reducing sugars increase as the organic acids diminish and vice-versa.

3) Those organic acids which, during the night, serve to excite the zymotic processes calculated to promote the migration into the leaves of the organic materials produced photosynthetically, are on the contrary transformed during the day, partly at least, into food substances, i e. carbohyrates.

4) The organs (branches and fruits) which present a stronger resistance to the attacks of parasites are the youngest organs, above all when in the period of growth and more acid.

5) The organic acids help to provide growing organs with that turgidity which is necessary in order to promote the zymotic processes which, by mobilising the stored materials, are to supply sufficient nourish-

ment to the growing organs; they contribute to this by absorbing and retaining the water in circulation.

6) In alkaline soils, such as limestone soils, and those irrigated with alkaline water, cultivated plants present a lesser quantity of free acid in their tissues and are more sensitive to adverse factors.

7) Oxydases are more abundant in the more juicy tissues and in those diseased organs which are richest in nitrogenous substances; they are most active in the hottest regions, where also the organic acids contained in the plants burn up; this combustion produces $CO_2$. which is eliminated, thus depriving the plant of the acidity required to render it resistant. For this reason, in hotter regions, other conditions being equal, the plant is more sensitive than in less hot regions. In proportion as the acidity of the juices in the organs diminishes, their sweet taste will become more evident, and the parasites will find them a more agreeable and more abundant food for their growth.

*Acidity of Sap and Plant Parasites.* — 1) Organic acids are poisonous to micromycetes.

2) The greater acidity of the sap produces a greater resistance in plants as follows : (*a*) wheat to rusts; (*b*) wine stocks to oidium, mildew and " tuberculosis " . (*c*) the olive to *Cycloconium* and *Stictis Panizzei* ; (*d*) the the pink, potato and hyacinth to bacterial infection ; (*e*) fruit plants in general to root rot and gummosis.

3) Pruning, by rejuvenating the branches and foliage of fruit trees, increases the resistance to adverse agencies.

*Acidity of Sap and Animal Parasites.* — 1) As the increase of the quantity of reducing sugars (very much sought after by insects) in an organ is attended by a reduction in the organic acids and *vice versa*, it follows that acidity is the weapon most used by the plant against animal parasites likewise. Among acids, however, the most poisonous appears to be malic acid.

2) The greater acidity of the vegetable juices presents a defence in the following cases : (*a*) the young branches of the white mulberry from *Diaspis pentagona* ; (*b*) the young citrus plants from *Pseudococcus citri* ; (*c*) citrus plants from *Crysomphalus dictyospermi;* (*d*) improved young fig trees and those obtained from seed, from *Ceroplastes rusci ;* (*e*) young olive trees from *Saissetia oleae* and *Philippia oleae;* (*f*) ordinary and citrus fruits, from attack by scale insects ; (*g*) olive trees, from the " fly "(*Dacus oleae*) ; (*h*) the grape, from *Albinia Wockiana* ;(*i*) vines, from phylloxera.

*Tannic Substances and Parasites.* — 1) Tannins, which are acid substances, behave like organic acids, and that is why they abound in growing organs, defending the latter against the attack of parasites, especially vegetable parasites.

2) In artificial nutrient media, the presence of tannin added in different proportions prevents the germination of the spores or else it stops the growth of the mycelium. In this case, tannin clearly causes a more effective antifungal action of the wall of the cell itself.

3) Antocyanine, as a substance derived from bodies (tannins) endowed with a relatively high osmotic power, contributed, like tannic sub-

stances, to increasing the resistance of plant organs against their parasites. For this reason, the varieties or races of fruits or grapes which are intense in colour, from red to violet and bluish, are always more resistant in comparison with varieties of the same species with more or less pale fruits.

4) The tannins co-operate with the other organic acids in defending the organs of the plants even against their animal parasites ; hence the pure or hybrid American races of vines, richer in tannic acid, are always more resistant to phylloxera, other conditions being equal.

*Selection, Crossing and High Grafting.* — 1) The resistance to adverse factors varies in the same environment, just as to the variety and the races of one and the same cultivated species. This resistance being inherited, it is essential to maintain it by renewed selection, the value of which is almost exclusively local.

2) Resistance is greater in the varieties usually held in least esteem ; in this case, when selection seems insufficient, it is indispensable to resort to hybridisation, especially for grasses, and to a high grafting on hardy stocks for fruit plants, unless reproduction by seed is resorted to.

3) With similar processes there have also been produced resistant races : (*a*) of wheat to rust, smut and lodging ; (*b*) of buckwheat, sugar cane and stone fruit Rosaceae, to heavy frosts ; (*c*) of asparagus to rust ; (*d*) of tomatoes, cotton tree and water melons, to wilt ; (*e*) of potato, to mildew ; (*f*) of strawberries, to mould; (*g*) of vines, to oidium, mildew and phylloxera; (*h*) of citrus plants, to gummosis and root rot.

*Manuring.* — 1) Potassium, lime, iron and magnesium must be applied to the plants in the form of sulphate exclusively ; the separation of the corresponding ions, which is done by the roots, would set at liberty the sulphuric acid, which, even in a very small quantity, would, by recombination, increase the acidity of the juice circulating in the organs of the plants and render resistance stronger.

2) Nitrate of soda is the nitrogenous manure which, more than any other, tends to reduce the acidity of the organs and render them more sensitive to enemy action ; sulphate of ammonia, on the contrary, causes a production which is somewhat less in quantity but renders the plants more resistant, because it tends to increase the acidity of their organs; in alkaline soils, the use of nitrate of soda will, by accumulating sodium, result in diminishing the original fertility and will produce progressive sterility.

3) An excess of nitrogenous manure, especially in the nitric form, causes an increase in the formation of starchy products which, like sugars, render the organs more susceptible to parasites. On the contrary, phosphatic manure produces a transformation of the soluble nitrogenous substances (or starchy substances) into insoluble nitrogenous substances (or phosphoproteins) which possess a negative chemotropism. This manure, while it accelerates the ripening of the fruit and lignification of the branches tends to protect them from the attacks of external agents and at the same time contributes to maintaining or increasing the acidity in the organs, thus strengthening them in their struggle against parasites.

4) In order as far as possible to ward off attacks on cultivated plants produced by physical agents and parasites, prophylaxis must be based on phosphatic manure, more or less assisted by an addition of sulphates.

938 - **Means of Control of *Chrysophlyctis endobiotica*, a Potato Pest in Germany.** — SCHAFFNIT E. and VOSS G., in *Zeitschrift für Pflanzenkrankheiten*, Vol. 26, No. 3-4, pp. 183-192. Stuttgart, June 1, 1916.

I. — *Experiments in Soil Disinfection.* — The experiments were carried out on fields over-run by the parasite, at Nederpleis, with a series of chemicals in different degrees of concentration. The disinfection of the soil was done between the 10th and 20th February, the plantation of tubers on the 25th April and the harvesting of the potatoes on the 29th October, Each plot had an area of about 7 sq. yds. The means of disinfection were: " Beta-Lysol ", sodium cyanide, chromium acid carbonate, " Flurasil ", kainit, calcium cyanamide, sulphur and " Uspulun ".

The kainit, calcium cyanamide and sulphur, as well as the mixtures of these materials, were first spread and then hoed in ; the " Beta-Lysol ", sodium cyanide, chromium acid carbonate, " Flurasil " and " Uspulun " were used in aqueus solutions. " Uspulun " is a preparation of mercury soluble in water : " Flurasil " is a compound of silica, fluorine and zinc. Both the products are prepared in Germany. Each experiments was repeated three times on plots situated at different points.

The results of the experiments, which are summed up in a table, show that none of the agents gives satisfaction in every respect. The best effect was obtained with chromium acid carbonate, which, on the plots treated, gave 3.94% of diseased tubers, and 11.59 % of stalks and leaves infested. Next come the plots which received a mixture of kainit and a large quantity of calcium cyanamide with 7.65 % of tubers attacked and 21.37 % of diseased leaves. The third place is occupied by plots which received sulphur or " Flurasil " ; the first of these had 10.14 % of diseased tubers and 31.81 % of leaf parts attacked, and the second 8.64 % of diseased tubers and 33.63 % of stalks and leaves attacked. The other means of control " Uspulun " (even in large doses), sodium cyanide and kainit produced no effect.

If the soil is not uniformly and equally reachedt hroughout its parts, the experiments rarely give a good result. Owing to this fact, the tubers on certain plots treated were more infected than those of the check plots. This year it is hoped that the drawback in question has been avoided by careful distribution of the plots over the soil at the time of autumn tillage.

To sum up, it may be stated that the disinfection of the soil appears to be successful in some respects, and for this reason the writers will repeat their experiments for several years.

II. — *Behaviour of the different varieties of Potato towards the disease* — 69 varieties were tested. Each plot had an area of about 4.5sq. yds. The potatoes were planted from the 25th April to the 30th May, and lifted from the 6th to the 30th October following.

The results showed that the following varieties remained immune from the disease : " Jubelkartoffel ", " Pulsens Juli ", " Rote Delikatess-Niere " " Reingold ", " Roma ", " Blaue Rheinische Rauhschale ", " Verbesser-

ter Tannenzapfen ", " Vater Rhein " and " Wohlgeschmack ". Part of the varieties were slightly attacked and part strongly (more than 50 % of the tubers). The soil of the plots was no doubt less infected by the parasite than that of the plots used for the disinfection tests. This year, the experiments will be repeated on a larger scale with those kinds which were found immune in 1915.

III. — *Vitality of the dormant spores of the fungus in the soil when the host is not cultivated thereon.* — Previous observations have shown that the dormant spores of *Chrysophlyctis endobiotica* Schilb. retain their germination capacity in the soil for 6 years. By way of checking this observation, the Writers acquired from the town of Kronenberg a field which was greatly over-run by the parasite, and which for that reason had not been cultivated from the end of the 1907 growing period till the spring of 1915. Two plots of the field were ploughed, situate at two separate points, and in the 15th April 1915 they were planted with the " Industrie " potato variety. On gathering the crop, a very strong infection was found on both plots. It clearly follows from this that the dormant spores may retain their vitality in the soil for 7 years. This year other plots in the field will be planted with potatoes, and the operation will be repeated subsequently in order to determine the time the dormant spores retain their vitality.

For practical agricultural purposes, it follows from these experiments that fields invaded by the parasite should not be put down to potatoes before the expiry of a period of 7-8 years, and it is even probable that the vitality of the parasite lasts still longer.

DISEASES OF VARIOUS CROPS

939 - ***Phytophthora* sp. Injurious to Oats in America.** — Mc Murphy James, in *Science*, New Series, Vol. XLIII, No. IV, p. 534. Lancaster, Pa., 1916.

Specimens of oats attacked by an unidentified species of *Phytophthora* were discovered in the vicinity of the University of Stanford and near Mayfield in California. Symptoms of the disease : spots and stripes of different sizes along the edges, or a long stripe running along the central line of the leaf. The parts attacked are first yellow, then whitish (when the conidia are abundant) ; finally they become brown, dry and break up.

The conidiophores, which are short and simple, emerge through the opening of the stomata and generally carry a single conidium. Chlamydospores and oospores were likewise found in abundance on the infested parts.

In regard to these characters, this *Phytophthora* approximates to *P. Colocasiae* a parasite of " taro " (*Colocasia esculenta*), in Java, India and Formosa.

940 - **Potato Diseases in the Dutch East Indies.** — Westerdijk J., in *Teysmannia*, XVIIth Year, Ist and IInd Parts, pp. 1-15, I Pl. Batavia, 1916.

The Writer was able, during his stay in the Dutch East Indies, to study the cultivation of potatoes in Java, where it is carried on in the mountains, at an altitude of 1300 to 6500 feet.

While the few European growers devote all the necessary care to this cultivation, the natives use seed potatoes, too small in size to be of any value

for consumption, for this purpose. In addition, they are sown too close in the potato fields, and the soil is insufficiently tilled and manured. They grow a variety of mediocre quality, but which is somewhat resistant to disease.

A description is given of the enemies observed on the potato. *Epilachna territa* largely destroys the foliage by gnawing it. *Phytophthora infestans* has been found in some plantations lying at an altitude of 5500 to 6500 feet ; the climatic conditions hardly appear favourable for a spread of this disease in regions of a lesser altitude. *Macrosporium solani* causes a dry rot of the foliage, and has been found at an altitude below 5500 feet. A root fungus, the attacks of which are somewhat dangerous to other crops, sometimes assails potatoes. A disease, the cause of which is still unknown and which is shown by the leaves rolling up, is rather frequent in some newly imported varieties. Finally, considerable damage is caused by the disease known in Germany as " Eisenfleckigkeit ". The diseased tubers do not differ externally in any way from the healthy ones. On cutting them open, brown spots are seen in the central tissues. These spots turn black when the potatoes are cooked. It has not been possible to find any very definite cause giving rise to this disease. Probably defects in the methods of cultivation, especially with the natives, very much influence its appearance, and an improvement will be observable when the usual methods are replaced by more rational ones.

941 - ***Cronartium ribicola* attacking *Ribes*, in Ontario.** — Howitt F. E. and Mc Cubbin W. A., in *Phytopathology*, Vol. 6, No. 2, pp. 182-185. Baltimore, Md., 1916.

In 1914 and 1915, in nine counties on the banks of the great Ontario lake, plantations of *Ribes* especially *R. nigrum* L. were considerably damaged by *Cronartium ribicola* Fisch. de Waldh.

The following cultivated and wild species were attacked : *R. nigrum*, L. ; *R. vulgare* Lam. ; *R. grossularia* L. ; *R. aureum* Pursh ; *R. cynosbati* L. ; *R. triste* Ball. ; *E. floridum* L'Hér. ; and *R. prostratum* L'Hér.

The aecidial form (*Peridermium*) is found on *Pinus strobus*, both native and imported, in the countries of Brant, Durham, Halton, Welland, Wellington and Wentworth.

In the spring, the infection spreads from the pine to the *Ribes* on which the teleutospore develops. It is, however, not impossible, although the experiments undertaken by the Writer yielded a negative result, that the disease may winter on the leaves of *Ribes* itself. As regards the susceptibility of the different species, *R. nigrum* is said to be the most susceptible. On the other hand, *R. rubrum* is thought to be much less so (the variety " London red " is entirly refractory) as also is *R. grossularia*.

It should be noted that this disease, which may be said to have no economic importance in Europe, may occasion extensive havoc in Ontario, owing to almost complete defoliation. With regard to the means of control, good results are obtained by applications of Bordeaux mixture or soluble sulphides for fifteen days during the summer.

942 - ***Sclerotinia libertiana*, injurious to *Forsythia viridissima*.** — PEGLION VITTORIO, in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, 5th Series, Vol. XXV, 1st Half Year, Part 9, pp. 665-657. Rome, May 7, 1916.

As early as the spring of 1915 the Writer, in some specimens of *Forsythia viridissima* in the garden of the School of Agriculture of Bologna (Italy), observed a withering of the shoots after flowering. An anatomical study of the lesions disclosed a limited but very pronounced disorganisation of the bark, and the presence of small black isolated sclerotia, mostly placed at the point of intersection of the leaf stem on the twig. According to the writer, the fungus is *Sclerotinia Libertiana*. If fragments of bark tissue are sown in nutrient gelatine, or if the withered shoots are placed in a moist room, there follows within a very short time a vigorous growth of mycelium and the differentiation of many large sclerotia.

The origin of this infection is to be sought during the flowering of the host. The flowers attacked adhere strongly to the stalk. On making a longitudinal section of these flowers, they are seen to be the seat of an extensive mycelial infection. The mycelium of *Sclerotinia* starts from the stigma and, passing along the style, enters the ovary, from which, traversing the leaf-stalk, it spreads in the cortical zone of the twig.

What here takes place is a mummification perfectly analogous to that produced by several species of *Sclerotinia* of the sub-genus *Stromatinia* in the female organs of various Rosaceae, and which, as is well known, are caused by the germination of ascospores or conidia (*Monilia*) on the stigma, followed by the penetration of the mycelium into the ovary, and from the latter into the branches.

The infection takes place when the vitality of the flower is already on the decline, because the germinal tube of the ascospores of *Scl. Libertiana* cannot develop in healthy vegetable tissues in full vitality. The infection is probably due to ascospores carried by the wind. The ascospores can germinate as soon as they are expelled from the ascus. In the cases reported by the writer they came from a plot cultivated with Jerusalem artichokes, where *S. Libertiana* is endemic.

Thus *S. Libertiana*, the pathogenic position of which was known in the typical forms of infection arising from injuries to the host (the writer is of opinion that it is anormal case of " chancre " or " Sclerotia disease " in hemp), from lesions following upon cold (as is the case with the Sclerotia disease of beans), is found to possess other means of penetration into its host, characterised by a more and more reduced period of life in the saprophytic stage. Such is the special form of the Sclerotia disease in the bean, described by PETRI (*Rendiconti della R. Accademia dei Lincei*, Nov. 20, 1914), in which the saprophytic stage develops at the expense of fragments of petals adhering by chance to the growing shoots, and finally the pathological process now in question which arises on the flowers of *Forsythia* and causes considerable injury to the stem of the host.

943 – ***Trichoderma koeningi*** **causing Root Rot of the Apple Tree, in Virginia.** — CRABILL C. H. in *Phytopathology*, Vol. 6, No. 2, pp. 159-161, Fig. 1, Baltimore, Md., 1916.

In Virginia, rotting of the roots of the apple tree occurs chiefly in the valley of Shenandoah and the district of Piedmont. It is responsible for very heavy damage, and nothing has up to now been done to control it. Trees from ten to fifteen years old are usually attacked. The pathological process is rapid and fatal. The first visible symptom of the disease is a stoppage of growth, followed by the partial falling of the leaves and the withering of the terminal buds. At the moment when these symptoms appear, the root system is already dead, the roots are cracked and fragile, and the tissues invaded by an abundant growth of mycelium. Infection begins with the deepest roots and progresses upwards.

The following facts have been ascertained : 1) the rot is more frequent in land cultivated for the first time, especially if it contains some decomposing vegetable residue such as tree stumps; it is rarer in localities already cultivated for some years ; 2) the rot is equally widespread in all types of soil, both on steeply inclined slopes and in plains and depressions ; 3) in orchards, several trees forming a group die at almost the same time, which is a proof of the rapidity whith which the disease spreads ; 4) " York Imperial " is said to be the variety most liable to attack ; next follow : " Stayman Winesap ", " Ben Davis ", " Yellow Newton " (" Albemarle Pippin ") and " Arkansas " (" Black Twig ").

The writer obtained many cultures from infected material of different origin, and in all cases obtained abundant growth and fructification of *Trichoderma koeningi* Oudemans.

| Place of origin of infected material | Number of cultures | *Trichoderma* | *Hydnum* | Bacterial Infection | Sterile |
|---|---|---|---|---|---|
| Middletown . . . . . | 14 | 14 | — | — | — |
| Middletown . . . . . | 10 | 1 | 7 | — | 2 |
| Roselands . . . . . | 10 | 6 | — | — | 4 |
| Pleasant Valley . . . . . | 26 | 12 | — | 11 | 1 |
| Fishersville . . . . . | 24 | 16 | — | 5 | 3 |
| Greenwood . . . . . | 16 | 14 | — | 2 | — |
| Greenwood . . . . . | 16 | 9 | — | 5 | 2 |
| Totals . . . | 116 | 72 | 7 | 23 | 12 |

*Trichoderma* may be regarded as the specific cause of root rot. Other fungi however may be associated with it, for instance *Hydnum* and a bacterial flora which is sometimes very abundant.

The growth of *Trichoderma* in starch agar, at ordinary temperatures, averages 1 cm. per 15 hours; hence the rapidity of the pathological process, which may bring about the death of the tree within a few days. The parasite grows equally well in any medium provided the latter does not contain an excess of alkali.

Copper sulphate in a dose of 0.1 % added to the agar stimulates the formation of spores. A soil rich in humus and well manured promotes the growth of the mycelium and the formation of the spores. The vegetative body of the fungus is found in all the elements of the xylem, from which it spreads into and between the cells. It cuts off light from them entirely and encroaches on and destroys the walls.

Its property of living quite easily as a saphrophyte, and the large number of spores which the wind scatters with extreme facility, render this parasite one of the most dangerous to the orchard, and it is necessary to take prompt and energetic control measures.

## WEEDS AND PARASITIC FLOWERING PLANTS.

944 - ***Cryptostemma calendulaceum, Crepis capillaris, Leonotodn hirtus* and *Carduus* spp., Weeds in New Zealand** (1). — ATKINSON E. H. in *The Journal of Agriculture*, Vol. XII, No. 1, pp. 32-39. Fig. 9; No. 3, pp. 175-187. Fig. 6. Wellington, 1916.

1. The Writer continues the description of the common weeds in New Zealand by describing *Cryptostemma calendulaceum* (capeweed), *Crepis capillaris* (hawkweed) and *Leontodon hirtus* (hawkbit).

The first of these Compositae is very common in the Northern island. Is has likewise been reported in numerous localities in the Southern island, where it tends to invade the pastures, choking and replacing the leguminosae and grasses best adapted for cattle feeding.

The two other species also occur very widely, but they should be rather considered as useless than injurious.

2. Description of 6 species of *Carduus* growing more or less frequently in New Zealand: *C. lanceolatus* (spear thistle); *C. nutans* (nodding thistle); *C. pycnocephalus* (winged thistle); *C. arvensis* (Californian thistle); *C. Marianus* (milk thistle) and *C. eriophorus* (woolly-headed thistle).

*C. lanceolatus* is certainly the species most widely distributed in the two islands. This species is the one which imparts its characteristic appearance to the meadow flora when vegetation grows after bush fires. *C. arvensis* is also very common. *C. pycnocephalus* is much rarer; in certain sterile and bare parts it often forms the sole winter forage for sheep. *C. Marianus* abounds in several localities, but tends to disappear with the development of cultivation. *C. eriophorus* only occurs along the rivers and in the valleys of Wairarapa and Otaki. Finaly, *C. nutans* has been reported in southern Canterbury and some localities of Otago.

(1) See *B.* March 1916. No. 363. (*Ed.*)

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

GENERAL

945 – **Contribution to the Life History and Anatomy of *Lyda hypiotrophica* (= *Cephaleia abietis*)** (1). — SCHEIDTER FRANZ, in *Zeitschrift für angewandte Entomologie*, Vol. 3, No. 1, pp. 97-116. Berlin, March 1916.

*Development of the eyes.* — During an outbreak of *Lyda hypotrophica* in the course of the last few years in Swabia and Upper Franconia, the Author, at different periods of the year (October, March-May) studied a large number of larvae. He first classified the larvae according to their colour and then counted them. He thus determined three groups of larvae clearly distinguished from each other.

The larvae of the first group, apart from the dark brown X on the forehead, had a head uniformly greenish brown or light brown in colour. Those of the second group are distinguished by an ill-defined dark brown spot on the cheeks. The larvae of the third group had an oval deep black spot just above the eyes (eye spot). The larvae of the last group might also exhibit a spot on the cheeks. The study made by the writer proved that the oval spots of the larvae in the third group are nothing else than the future eyes of the pupa and the adult.

The writer calls them " pupal eyes ". They are found in all the larvae which undergo transformation into pupae in the following spring.

Wishing to study the question more fully the writer examined a number of larvae of the first two groups mentioned above from the point of view of the genital organs. He found that in larvae which in the spring had not yet got pupal eyes, the genital organs had not yet developed. On the other hand the larvae having " pupal eyes " all had well developed sexual organs in March and April.

At what time of the year do the pupal eyes appear ? The larvae ready for pupation already possessed them in March ; on those which were without these eyes and which were enclosed in a cage they were not seen to appear after that time, that is, after the end of March. In some cases (17 larvae out of 9000 larvae studied) the " pupal eyes " were already observed in October.

The writer concludes that the pupal eyes do not always form in autumn in the larvae which pupate in the following spring.

The larvae which already showed the pupal eyes in October had well developed genital organs, but the development was not so far advanced as in the larvae studied in March and April.

In practice, it is important to be able to ascertain as early as March, on the basis of the " pupal eyes ", whether or not there will be a large number of adult insects in the spring.

*Number of eggs.* — The writer also studied the number of eggs which a female can lay ; he found that the indications given on this subject by the literature (maximum of 25) are inaccurate.

(1) See *B.* July 1916. No. 839. (*Ed.*).

These investigations, which are not yet terminated, appear however to have shown that this figure is too low. It is quite possible for a female to lay up to 100 eggs.

*Development of the genital organs* — The investigations carried out show that the larvae of *Lyda* ready for pupation already possess well developed sexual organs while in other insects, *e.g.* the lepidoptera, the ovaries are still little developed even in the last larval stage. The genital organs form during the summer and autumn, at the same time as the " pupal eyes ", but the Author does not think that there is any relation between the formation of these two organs. The testicles develop more rapidly than the ovaries. A very detailed description is given of the genital organs and the formation of the eggs.

The freshly emerged female, after mating, lays in the first oviposition about 30 eggs ; later on, when the weather is hot, it lays more. Oviposition is complete at the end of 7 days. If it is rapid and intense the adult dies after 8 days of life. The arrival at maturity and oviposition are closely related to the weather ; hot weather promoted them, bad weather hinders them. If bad weather is sufficiently prolonged the females die before ovipositing, and the consequence frequently is a rapid diminuton of the insects in the forest.

*Colour of the larvae.* — Generally green larvae and yellow larvae are distinguished, but there are also all kinds of shades between these two groups. Among the larvae studied in 1913, 88 % were green and 12 % yellow. The hypothesis that the green larva is male and the yellow female was not confirmed by the present investigations. The colour is not changed until the larva has pupated.

It is likewise not true that the yellow larvae are individuals covered with parasites. The difference in the colour results from the blood of the larvae.

*Parasites.* — *L. hypotrophica* appears to suffer little from parasites ; no parasites are known to attack the eggs, pupae or adults. On the other hand the larva is attacked by some species of Ichneumonidae and Diptera, but not to a great degree.

The larva of Ichneumonidae found by the writer in the larva of *Lyda* in October and spring, were still very small : 3-4 mm. Later, in the month of March, they were 6 mm. On being placed in a hot room they developed more rapidly, and produced adults within a few weeks.

The larvae of Ichneumonidae completely absorb the larvae of *Lyda* so that after a time nothing remains but the empty skin. They afterwards leave their hosts in order to pupate.

The Tachinid larvae living in the larvae of *Lyda* are more developed than the Ichneumonid larvae. They were already completely developed in October and entirely filled out the *Lyda* larvae.

They would remain therein during the winter and would only pupate in the following spring, when the weather is warmer. Thus these parasites are only found in small number in the larvae of *Lyda*

The larvae of Ichneumonidae and Tachinidae are only found in those

*Lyda* which have pupal eyes. From this it follows that these parasites have a single generation per year, and that they only attack the *Lyda* larvae still living on the tree.

*Control.* — Judging from the life history of Lyda, it seems that expensive control measures are not justifiable. The larvae almost always eat the needles of the previous year and very rarely those of the actual year. Consequently the developing buds are not attacked by them. The growth of the trees suffers from the influence of the larva, but not very much. It is consequently advisable to abstain from any control measures against this enemy. The writer recommends that greater importance should be attached to the other enemies of the spruce which accompany *Lyda*, such as: *Pissodes hereyniae, P. scabricollis, Ips typographus, Pityogenes chalcographus*, etc. The method of pasturing pigs in the forest in order to destroy the larvae of *Lyda* is hardly practicable.

946 - **White Grubs (*Lachnosterna* spp.) in Wisconsin, United States of America.** — SANDERS J. G. and FRACKER S. B. in *Journal of Economic Entomology*, Vol. 9, No. 2, pp. 253-261, Fig. 3. Concord, N. H., 1916.

The results are here set out of a series of researches and experiments on white grubs (*Lachnosterna* spp.) undertaken at Madison, Wisconsin, in 1914-1915.

In order to capture the insects, light traps were employed (Coleman gasoline lamps of 300 to 400 candle power) placed near the receptacles containing water to which paraffin had been added, into which the insects, attracted by the light, fall. In Wisconsin there are five Stations (Lancaster, Dodgeville, Baraboo, Madison and Ripon) each provided with eight lamps.

From May to June 1915 there were captured 1 036 400 specimens of *Lachnosterna* belonging to the following species: *L. fusca, L. rugosa, L. grandis, L. dubia, L. hirticula, L. gibbosa, L. ilicis, L. balia, L. tristis, L. nitida, L. implicita, L. marginalis, L. vehemens, L. nova, L. prunina, L. inversa* and *L. villifrons, L. fusca* certainly the most widely distributed species; *L. rugosa* was not reported at Lancaster but was very common in the other Stations lying further north.

In the early morning, in the evening, and generally when the days are cold, the larvae are rarely active and do not feed. On the other hand they are very active and voracious during the hottest hours of the day. Migrations in a vertical direction commenced by the insects under the influence of temperature variations are never observed in the soil. The larvae generally remain at the same level near the surface of the soil from which they only shift to go in search of their food. The latter consists of root or parts of roots. If the larvae are brought into contact with freshly germinated young plants they attack and destroy the radicle without touching the stem. They refuse bran or sweetened dough.

A number of larvae were left for five and a half months in a vessel containing only soil, and no food was given them. At the end of the period of experiment, two larvae were still alive and active; they had fed only on the small amount of vegetable detritus contained in the soil. In view of this

vitality and resistance it is not possible to use control methods based on the starvation principle.

In some experiments carried out on land infested with the larvae of *Lachnosterna*, grasses were transplanted the roots of which had first been steeped in a solution of arsenite of soda; the mortality of the larvae amounted in four days to 22.2 %. Under the same conditions the use of arsenate of lead gives negative results. If roots of young maize plants are poisoned with corrosive sublimate, the mortality of the larvae reaches 50 %.

Excellent results are obtained by protecting the seeds by treatment with creosote ; this substance keeps the larvae off.

RESISTANT PLANTS.

947 - **Resistance of Different Varieties of Wheat to *Mayestiola detructor* in America.** — HASEMAN L. in *Journal of Economic Entomology*, Vol. 9, No. 2, pp. 291-294. Concord, N. H., 1916.

The destructive cecidomyiid " Hessian fly " (*Mayetiola destructor* Say) has caused very extensive injury to wheat almost throughout the great Mississippi valley.

The opinion generally held by farmers is that all varieties of wheat are not equally susceptible to attack, and that some types remain practically immune.

In order to ascertain the truth of this opinion, and also to arrive eventually at a selection of highly resistant types, a series of experiments was undertaken on a very large number of wheat varieties. In these researches there were ascertained the percentage of infected plants, the relative number of larvae, etc. ; analyses were also made of the composition of the plant organs and sap, and observations on the manner in which development takes place, in order to fix and establish possible correlations. In the present work there are set out the results of a first year of research. These results do not yet possess the value of definitive conclusions, but they are none the less interesting, as they confirm the fact that the various types behave variously as regards the attack of *Mayetiola destructor*.

3 varieties of wheat were used : " Fultz ", " Fulcaster " and an indigenous type regarded as very resistant.

Sowing was carried out on the 24th October, 1914. On the 10th May, 1915 the following observations were made :

| Varieties of Wheat | % of infected plants | Maximum number of larvae per plant | Average number of larvae per plant |
|---|---|---|---|
| " Fultz " . . . . . | 58 | 18 | 2.72 |
| " Fulcaster " . . . . . | 66 | 8 | 1.46 |
| Indigenous used as control. . . . | 54 | 12 | 1.7 |

As regards this experiment, " Fulcaster " presents marked tendencies to immunity if compared with " Fultz ". Furthermore, the results also prove that an indigenous type believed to be highly resistant may in reality be as badly attaked as some selected types.

The following particulars of yields were also obtained :

| Varieties of Wheat | Number of ears | Weight | Weight of 100 ears |
|---|---|---|---|
| | | | gr. |
| " Fulcaster " . . . . . | 371 | 334 | 90.30 |
| " Fultz " . . . . . | 439 | 324 | 73.80 |
| Indigenous control . . . . . | 367 | 273 | 74.38 |

According to the analyses hitherto carried out, a relation between the degree of immunity and the ash content appears to be outlined :

| Varieties of Wheat | % of ash in young plants | % of ash in straw |
|---|---|---|
| " Fultz " . . . . . | 15.146 | 5.147 |
| " Fulcaster " . . . . . | 15.379 | 4.598 |
| Indigenous . . . . . | 14.796 | 4.751 |

The degree of infestation in the three varieties appears to vary in direct proportion to the ash content.

MEANS OF PREVENTION AND CONTROL

948 - ***Aspidiotiphagus citrinus*, Endoparasite on *Chrysomphalus dictyospermi* in Italy.** — MALENOTTI ETTORE in *L'Agricoltura italiana*, IInd Year (Vth series), pp. 73-75. Pisa, May-June 1916.

While collecting *Coccidae* on plants cultivated under glass at Florence, the writer observed a case of parasitism of *Aspidiotiphagus citrinus* (Craw.) How. on *Chrysomphalus dictyospermi* (Morg.) Leon.

This endoparasite, which often hatches from *Aspidiotus hederae*, *A. betulae* and many other species of diaspids, had only been reported previously as a parasite of *C. dictyospermi* in one single case, namely by H. E. HODGKISS, at Cromwell, Connecticut, on hot-house palms.

The degree of parasitism of *Chrysomphalus* by *A. citrinus* was very great. Of 121 females observed on two leaves, there were 21 which had died naturally, 97 parasitised, and 3 free. On other leaves of the same plant the coccids were likewise parasitised in large proportions.

The observations made now allow of establishing clearly the differences between the behaviour of *A. citrinus* as compared with *A. lounsburyi* Berl. and Paoli on the same host. These differences are due in part to the dimensions of the adults of the two parasites which are markedly smaller in the case of *A. lounsburyi*, and in part again by the different pathological action they exercise on their victims.

*Chrysomphalus dictyospermi*, so strongly attacked by *A. citrinus*, was gathered by the Author on leaves of *Sansevieria arborescens* imported from the Natural History Museum of Paris. The species originates from tropical Africa and the East Indies.

The writer was unable to ascertain whether *C. dictyospermi*, which, according to the supervising staff, has always been seen on *Sansevieria*, brought its parasite with it, or whether the latter arises from the Italian form which adapted itself to the imported coccid. In the hot houses of Florence examined by the writer *Chrysomphalus* is not found on citrus

plants. On the other hand specimens were gathered on *Cymbidium Tracyanum, Aralia Reginae, Kentia* sp. and *Arenga* sp., but in small quantity and also attacked by the same endoparasite.

No such effective parasitism takes place on the citrus plants in full cultivation infested by the "bianca-rossa" (*Chrys. dictyospermi*). The case observed by the writer might therefore be explained by the mild temperature and tranquillity which are peculiar to the environments constituted by glass houses, and in the fact that this polyphagous (or, more accurately, polyxenous) insect was compelled for several successive generations during the year to lay its eggs on the same diaspid, which relatively, was not numerous.

949 - **An undetermined Nematode Worm Parasitic on Aphids.** — DAVIS J. JOHN., in *Psyche*, Vol. XXIII, No. 2, pp. 39-40, Fig 1. Boston, Mass., 1916.

The writer has discovered an as yet undetermined nematode in the interior of the body of some aphids (*Anoecia* sp.) living at a slight depth on the roots of *Muhlenbergia* in the evirons of Lafayette, Indiana.

This is a very rare case of parasitism. In 1899, DEL GUERCIO also described a nematode as a parasite and natural enemy of *Erama radicis* Kaltenbach. Other cases of this kind had not been reported since.

950 - **Nicotine Products tried in Germany against "Cochylis" and "Eudemis."** — KOTZEL in *Landwirtschaftliche Zeitschrift für die Rheinprovinz*, 17th Year, No. 18, pp. 261-265. Bonn, May 5, 1916.

In the spring and autumn of 1915, in two vineyards containing 2400 stocks, at Bullay a. d. Mosel, the writer carried out experiments of control of "Cochylis" and "Eudemis," with the following nicotine substances: 1) "Nikotin Florkus Pulver" of the brothers Nördlinger, at Flörsheim; 2) "Queria-Heu-und Sauerwurmpulver" of Otto Hinsberg, at Nackenheim a. Rh.; 3) tobacco juice containing 9-10 % of nicotine, with the addition of a 1 % solution of cotton oil soap.

The nicotine powders considered to be most effective against "Cochylis" were applied under strong pressure, on the 1st June, when the larvae had attained a length of 2-3 mm. The directions for use of the products in question state that at that time alone it is possible to obtain the best results with the powders.

The tobacco juice was dissolved in water (1.5 gallons to 100 gallons of water), then applied on different bunches on the 2nd June, immediately after oviposition.

The result of the treatment was observable as early as the end of June, in counting the coccids on the different branches. A vineyard 5 years old, which was divided into 3 plots, contained on 40 stocks, the following numbers of larvae per plot.

| | | | |
|---|---|---|---|
| Plot 1: | treated with nicotine solution . . . . . | — | 148 larvae |
| " 2: | " " "Queria" powder . . . . . | — | 270 " |
| " 3: | " " "Nikotin-Florkus" powder . . | — | 138 " |

In an old vineyard there were counted, for 40 stocks the following number of larvae:

| | | |
|---|---|---|
| Plot 1 : | treated with " Queria " powder . . . . . | — 321 larvae |
| " 2 : | " " nicotine solution . . . . . | — 163 " |
| " 3 : | untreated . . . . . | — 272 " |

In neither of the two vineyards did the " Queria " powder act, and the nicotine solution and " Nikotin-Florkus " powder also failed to give good results. In the course of the summer, however, it was observable that the grape treated with nicotine solution was healthier, and that the stocks untreated and those treated with nicotine powder contained many grapes of inferior value. By adding cotton oil soap to the nicotine its effectiveness is increased.

The control measures undertaken in autumn were only carried out with nicotine solution. Two vineyards were treated from the 20th or 22nd July with a preparation of 1.5 % strength to which cotton oil soap had been added, so that the grapes were completely wetted.

The vineyards were 5 years old ; in one there were found in the middle of September, on 50 stocks of each plot, the following number of grapes attacked by " Eudemis ".

| | | |
|---|---|---|
| Plot 1 : | treated with a 1.5 % solution of nicotine . | — 235 grapes |
| " 2 : | not treated . . . . . | — 636 " |

An old vineyard showed, on 72 stocks per plot, the following numbers of grapes attacked :

| | | |
|---|---|---|
| Plot 1 : | treated with a 15 % solution of nicotine . . . | — 1573 grapes |
| Plot 2 : | not treated . . . . . | — 7475 " |

The effectiveness of control by nicotine in autumn was very remarkable. The grapes were more developed, while the untreated plots contained bunches with but few grapes.

Nicotine acts most effectively when dissolved in water and applied under strong pressure to the inflorescences and bunches.

Many vine-growers mixed the tobacco juice with Bordeaux mixture ; they afterwards added a little soap, and then the whole was spread on the stocks by means of ordinary sprayers. Success in also obtained in this way, although the number of parasites killed is not very high. The process, however, has one disadvantage, namely, that the mixture used for control is too adhesive, remains too long on the grapes, and is difficult to remove by the rain. The grapes thus acquire a bitter taste due to the sulphate of copper. Owing to this fact many musts were found to have a bitter taste in 1915, which is the reason why this method of control is not recommended by the author.

951 - ***Gryllus servillei*, an Injurious Orthopteron in New Zealand.** — CLIFTON E., in *The Journal of Agriculture*, Vol. XII, No. 3, pp. 187-189. Wellington, 1916.

INSECTS INJURIOUS TO VARIOUS CROPS

The black cricket (*Gryllus servillei*) often, during the summer, causes considerable damage in some districts of New Zealand. Generally the lands to suffer most are those recently improved, where there are abundant pools of water and great humidity.

As means of control it is advised : 1) to drain the pools ; the numerous

larvae concealed therein die on exposure to the sun on the dry soil; 2) to graze sheep on the cultivated lands : many insects are crushed by the flocks ; 3) to spread here and there in the most infected places poisonous substances (for instance arsenic salts) kneaded with bran and molasses, which the insects eagerly devour.

952 – ***Batrachedra rileyi*, a Microlepidopterous Pest of Maize in America.** — HARNED R. W., in *Journal of Economic Entomology*, Vol. 9, No. 2, pp. 295-298, Fig. 2. Concord, N. H., 1916.

During the last few years, the larvae of the small pink corn worm (*Batrachedra rileyi* Wals.) have caused much injury to maize, both in the fields and warehouses, in almost all the counties of the State of Mississippi.

In 1914, the invasion was limited to the central part of the region (county of Attala) from which, in 1915, it reached all the other counties, which caused the gravest anxiety to farmers.

The writer's observations during the entomological campaign which he undertook on that occasion may be summed up briefly as follows :

1) In the plantations affected, the number of infested ears varies from 10 to 99 % and the number of larvae per ear, according to ARNOLD'S figures averages $4\,^{8}/_{37}$; 2) these larvae partly destroy the rachis and the grains, of which they sometimes devour the whole interior, only leaving the thin external integument intact ; or else they mine tunnels when going from one grain to the other, and will even feed on the grains already injured and gnawed by other insects, often completing the destruction of such grains ; 3) in warehouses, the larvae of *Batrachedra* generally infest the stored material from November to December, although they are often discovered even in April ; 4) plantations situated on hills generally suffer much more than those in the plain ; 5) early varieties of maize contain less larvae than late ones ; 6) the parasite usually attacks the tip of the ear, from which it encroaches on the other grains and even the rachis ; the frosts in January 1915 were fatal to a large number of the said larvae.

953 – **Variegated Cutworm (*Peridroma margaritosa*), a Macrolepidopterous Pest of the Sugar-beet in California.** — BENSEL G. E., in *Journal of Economic Entomology*, Vol. 9, No. 2, pp. 303-306. Concord, N. H., 1916.

The variegated cutworm (*Peridroma margaritosa* (*saucia*) Hübn., which has become very common in the country of Ventura, has during the last few years been responsible for widespread havoc to sugar beet plantations, but especially when the season was cold and foggy.

The larvae of the insect remain concealed during the day in the ground, at a depth of 3 to 5 cm., and come out at night in search of their food. They sometimes attack the aerial parts of the beet to the extent of entirely stripping them of their foliage. In some cases the attack extends to the roots, which are more or less spoilt and gnawed.

Among the natural enemies of *Peridroma* there are two species of *Calosoma : C. semilaeve* Lev. and *C. cancellatum* Esch.

The following artificial means of control have been successfully applied : 1) the application of arsenical compounds by means of sprayers

fitted with a special 1 HP gasoline apparatus which serves to maintain a pressure of about 120 lbs during the operation; 2) applications of aceto-arsenite of copper in powder, applied in the morning when the leaves are still covered with dew, which facilitates the adhesion of the preparation; 3) the use of light traps (electric or acetylene lamps near which are placed receptacles containing water to which paraffin has been added); in this way 1 000 000 adult insects were captured in a single season.

954 - ***Epochra canadensis*, a Dipterous Pest of *Ribes* in America.** — WHITNEY L. A. in *Monthly Bulletin of State Commission of Horticulture*, Vol. V, No. 4, pp. 152-157, Fig. 52-55. Sacramento, Cal., 1916.

The yellow currant and gooseberry-fruit fly (*Epochra canadensis* Loew) causes great injury to *Ribes* spp. in numerous localities of the United States and Canada. The female, by means of its sharp-pointed ovipositor, lays its eggs in the interior of the fruits, and the larvae emerging from them devour and spoil the fruits to a large extent.

As means of control, applications of arsenate of lead are advised at the time of appearance of the adults, according to the following formula: arsenate of lead, 4.9 lbs., molasses, 2.5 galls., water, 82.3 gals.

955 - **Hickory Twig Girdler (*Oncideres cingulata*), a Coleopterous Pest of *Diospyros virginiana* ("Persimmon") in the United States.** — See. No. 872 in this *Bulletin*.

ALFREDO RUGGERI, *gerente responsabile*

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

# INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (*Ed.*).

FIRST PART.

# ORIGINAL ARTICLES

## Historical Review of Canada's Timber Industry

by

JAMES LAWLER.

When the adventurous sailors from Europe first visited the part of North America now known as Canada they were not looking for timber. They were seeking a passage to India and China and, failing that, desired to carry back in their ships large value in small compass — gold, silver, precious stones, furs. But though they did not seek them the forests were there, covering the shores of bay and headland and the banks of rivers, — forests of pine, spruce, hemlock, oak, maple and birch. They stretched away as far as the eye could see from the most lofty lookout. They were dark and sombre and presented a maze which none but a native could thread and — worst of all — they effectually concealed those natives and their intentions, leaving the pioneers a prey at once to loneliness and fear.

Some writers have lamented that North America on the east side was found by the earliest settlers covered with these heavy forests which rendered life exceedingly difficult and precarious for the colonists, while the interior was a vast treeless plain or prairie whereon the settler might have secured abundant crops in one or two seasons. By the time that settlement had reached the prairies, the timber had largely been destroyed and part of the energy of several generations had been wasted in trying to make farms on certain areas of inhospitable non-agricultural land along the sea-coast. It is idle to speculate in this manner and, doubtless, had the forests been in the interior and the prairies on the shores of the continent the early settlers would have suffered as much from lack of fuel and building material as they actually did from lack of arable land in which to grow crops

## Conditions during the French regime.

The country was taken for the king of France by Jacques Cartier in 1534, but it was over a century later before anything began to be heard about the timber as an asset. The first timber regulations, as appears from a grant of land made in 1683, were made in regard to the reservation of oak to build the King's ships. The remainder of the timber was of no consequence. In fact, as the first need of the colonists was food, the endeavour was to get cultivated land upon which crops might be raised, and the forest was deemed an enemy to be conquered and obliterated. During the French regime the timber was not considered apart from the land. The colony was divided up into large blocks of land, from 100 to 500 square miles in extent, which were granted to seigniors or feudal lords upon conditions involving the settlement of these lands with tenants or fetainers, commonly called "habitants", who held whatever rights they had, not from the Crown but from the seignior, under feudal tenure.

Timber formed such a negligible part of the commerce of that day that the only question considered was its apportionment among the different parties to these land grants, the Crown, the seignior and the "habitant".

The determination of the pioneer settlers to get rid of the trees which encumbered their lands and their use of fire for this purpose was later felt in the shortage of timber for fuel in the immediate neighbourhood of centres of population, so that by 1720 stringent laws were passed against trespassing by the inhabitants of towns and villages on the lands of their neighbours to cut fuel.

## New regulations with British occupation.

When the British took possession of New France in 1763 their solicitude, like that of the French, was to secure timber for the building and repairing of the royal navy — oak (*Quercus alba*, or *Q. rubra*) for hulls and pine (*Pinus strobus* or *P. resinosa*) for masts. But their views went a step further than those of their predecessors. They desired not only to secure existing stands of oak and pine, but also deemed it advisable that any areas particularly suited to the growing of these species should be set apart and protected, so that they might supply timber in perpetuity. The instructions of the British Government to the first Governor, James Murray, are clear on this point and these instructions were repeated when Governor Guy Carleton took up his duties in 1775.

If this policy had been followed, and non-agricultural lands reserved for timber as settlement advanced into the country, the whole history of timber regulations and the development of the timber industry in Canada would have been changed and Canada would have been better off in regard to both agricultural and forest development, but this was not to be. Such a policy of examination, segregation and conservation was over a century in advance of the time. Nor, regrettable as was this falling away from an

ideal, could an adhesion to such a policy be expected under the circumstances. When over one hundred years later men supplied with the latest information were still talking about "illimitable" and "inexhaustible" forests it was not to be expected that in 1775, before the days of systematic surveys, men would have the foresight to persist in conserving what seemed almost too cheap and too abundant.

The trade in timber for the British navy began practically with the British occupation of the country. The commercial trade followed in the wake of this business. In fact it was begun by the contractors who received licenses to cut timber for the navy. This commercial trade, however, grew very slowly, chiefly owing to the opposition of British builders who claimed that timber from the Baltic region was much superior to that from Canada.

During and after the Napoleonic wars, however, the British government imposed heavy duties to pay for those wars, and in these duties gave substantial preference to the colonies. In 1803 Great Britain imported 12,133 loads (a load equalled 50 cubic feet) of timber from British North America and 280,550 loads from European countries. In 1820 the figures had changed to 335,556 loads from the colonies and 166,600 loads from European countries.

In the early years of the nineteenth century, timber was imported from the United States into Canada, but only for the purpose of shipping out again to Britain in order to take advantage of the preference granted to colonial timber. Duties on such timber coming into Canada were imposed by an Act passed by the British Parliament in 1820. Shortly after this, Canada began to export lumber to the eastern United States and from that time onward the trade grew very rapidly, until in 1867, the year when the British North American colonies were confederated into the Dominion of Canada, the value of timber exported to Great Britain was $ 6,889,783, while the value of that exported to the United States was $ 6,831,252. The growth in the home use of timber has been even more rapid than that of the export trade.

## Genesis and development of Canadian Timber Regulations.

In the military, political and commercial exigencies of the nineteenth century the policy of conserving any natural resources was almost completely forgotten. There were individuals who had more information than their neighbours on this subject, but, speaking generally, the idea of all people in Canada was that the sooner the adjacent and circumjacent forest was removed the better, because then the area of agricultural settlement would be increased and this was the hope and aim of the legislators and the people alike. In the settlement of Eastern Canada from the Atlantic to Lake Huron the progress of settlement was practically always from a waterway into the interior. The settlement was founded on a seacoast, bay, river or lake, and townships or parishes, ranging from three to ten miles square, were marked off extending landward from the water's edge. Behind

the front row of townships came another, and, so on, into the interior, as far as the need of the day demanded. The people saw the first and second rows of townships cleared and filled with farmers, and reasoning from these totally insufficient data, they imagined that the timber administration would settle itself. They thought that all that was necessary was to give the lumberman the right to take off the timber and that the farmer, ever on his heels, would press him further into the interior where it was believed more and better timber existed. In fact this idea of getting the lumberman to take off the timber without delay was so strong in the minds of early legislators that a clause was inserted in all contracts in Upper Canada and Lower Canada (Ontario and Quebec) that they must cut at least one thousand feet per acre per year. This was later reduced to five hundred feet per year, but the underlying idea remained as the spirit of the regulations. In the public mind the real and natural occupier of the land was the farmer and the lumberman was viewed as a necessary evil, who must be tolerated because he paved the way for the farmer. When anything like lack of markets or transportation interfered with the operations of the lumberman the settlers did not hesitate, even long after the timber trade was established, to cut and burn the most magnificent timber in huge piles containing thousands of feet.

### Lands leased, not sold to lumbermen.

This being the state of affairs, the system of leasing tracts of land to lumbermen for sufficient time to enable them to take off the timber was the natural outcome. When a settlement was begun, say at the mouth of a river, a lumberman would be given in the spring the lease of a block of land technically known as a "limit" (1), either back of the settlement or farther up the river, with the understanding that he would take off the timber during the following autumn and winter, so that farmers might enter upon the land the next spring. Thus in a great part of Eastern Canada to-day the timber is cut by lumbermen who lease the ground upon which the timber grows from the government, under an annual lease which terminates on the first day of May. Since the lumberman was viewed as a bird of passage, always being pushed farther back into the unknown interior where in the public mind the timber was always "illimitable and inexhaustible", he did not gain possession outright of the land on which the timber grew. While in the province of Nova Scotia the great proportion of the timber land is held by purchase or grant in fee simple yet, viewing the whole of Canada, the proportion of timberland held in fee simple is so small that practically the leasing system may be said to be the rule. Probably less than 5 per cent. of the timberlands of Canada are owned in fee simple, the remainder being owned by the different provincial governments or by the Dominion Govern-

(1) So called because the lessee must not cut timber outside certain stated limits or boundaries.

ment, and such areas as are now being worked are leased to the lumbermen, the revenue arising from leases and timber dues going to these governments and amounting at the present time (1916) to about $7,500,000 per year.

The point that is overlooked in the theory that the lumberman is to be regularly pushed back as settlement advances is that all soils are not suited for agriculture. If it had been conceived by the general public in Canada, say in 1840, that there were tracts of land near the first settled parts of all the eastern provinces that would grow fine timber but would never grow profitable grain or root crops, then provision, probably, would have been made for managing these areas permanently as forests. The law would not have been based on the supposition that timber was but a passing resource but a classification of soils would have permitted the two industries, farming and lumbering, to be developed side by side to the best advantage of both.

When the lease was executed, since the timber was the object of the lessee, the ground rent was set at a figure comparatively trifling. There was then a stumpage tax (1) (or dues ) of so much per thousand feet, which was collected annually after the timber had been cut and measured. It was later seen, however, that one limit might be much more advantageously situated as to transportation or have a better quality of timber than another and that a uniform stumpage tax alone was unfair. This was got over by auctioning off these leases to the highest bidder. The dues and ground rent being fixed, the government asked for a premium or "bonus" over and above these fixed charges and the lumberman who offered the highest premium got the limit. Starting at an average of about five dollars per square mile of limit in the sales of 1849, these premiums rose steadily with the advance in the price of timber until in the Ontario sale of 1903 the average premium over a large number of limits was over $ 4 000 per square mile and the highest premium paid was $ 31,500 per square mile for a limit ten miles in extent.

Since the underlying idea of the present timber regulations is that the land will eventually be occupied by the farmer, there is generally a provision in the older leases whereby upon notice being given the lumberman must, at the date fixed, abandon part or even all of his limit to allow farmers to settle and begin operations. These farmers can use the timber, or certain parts of it, without paying stumpage dues or rents. The result has been that again and again men who had no intention of farming secured the right to settle on lands for the ostensible object of cultivating them when their real object was to cut the timber and sell it. This class of men is known as the "bogus settler"; and the drawing of a fair line between the lumberman and the real settler on the one hand, and the bogus settler

(1) "Stumpage tax" gets its name from the fact that in the early years the collector of timber revenue counted the number of stumps and from this estimated the amount of timber cut and the amount of the tax. In recent years a government measurer or "scaler" measures the actual logs as they are cut.

on the other has for half a century been one of the difficulties of Canadian forest administration.

This plan of annual leases, with ground rent dues and bonuses, continued to be the method for many years in Canada, and, generally speaking, when the interior provinces and British Columbia came to be opened up it was the method applied to the forests therein.

Canada, it must be remembered, existed previous to 1867 as a group of British Colonies each independent of all the rest, though all owing allegiance to Great Britain. When the colonies on the eastern side of the continent were federated into the Dominion of Canada in 1867 an apportionment of assets and liabilities, rights and duties, was made as between the colonies (which at that time became provinces) and the new Dominion or federal government. By this apportionment the provinces retained the possession and management of their lands and forests. British Columbia, which was a British Colony on the Pacific coast, came into the federation later under the same arrangement. One of the objects British Columbia had was to get railway connection with the Atlantic coast and, to assist in securing this, British Columbia granted to the Dominion Government a strip of territory forty miles wide and about five hundred miles long through the province from east to west — twenty miles on each side of the railway which should be built.

Canada consisted then of the old colonies of Nova Scotia, Prince Edward Island, New Brunswick, Quebec and Ontario (Lower Canada and Upper Canada) on the Atlantic Seaboard. British Columbia on the Pacific joined the confederation a little later. In the interior was a stretch of prairie country, roamed over by bison and redmen (North American Indians), and, since 1670, under the control of a British trading company — the Hudson's Bay Company. The Dominion of Canada, for a cash payment and other considerations, bought out the rights of the Hudson's Bay Company, and after a period of direct federal control, created three provinces in this territory: Manitoba, Saskatchewan and Alberta. These provinces were given a cash subsidy in lieu of their lands, minerals and forests. The result is that the older provinces, that were originally colonies, retain the management of their lands and forests, while in the newer provinces of Manitoba, Saskatchewan and Alberta, and in the forty-mile-wide strip through British Columbia on each side of the Canadian Pacific Railway, the Dominion Government manages the lands and forests.

The settlement and commercial and governmental development of Canada from the Atlantic coast to the Rocky Mountains has been uniform from east to west, and throughout this region the selling of the timber and the leasing of the land under it by the government to the lumberman has been the basis of the timber administrative system. British Columbia, the only province which lies west of the Rocky Mountains, was settled by people who reached it from Great Britain and Eastern Canada by way of Cape Horn or the Isthmus of Panama or by the overland route through the United States. Lumbering in this province was begun in 1827 by Dr. John McLaughlin, a Chief Factor of the Hudson's Bay Company, who

set up a saw-mill which sawed one thousand feet, board measure, a day. Even here, however, the leasing system was the basis.

The underlying theory that the farmer would soon push back the lumberman from his present limits into the unexplored hinterland is the probable reason for the indefinite character of these leases in regard to termination. In the first instance they were all yearly leases and to-day the great majority retain this form. In Nova Scotia the small amount of forest land held by the Crown is leased for varying terms from one year up to 99 years; in New Brunswick there is now a fixed term of twenty years with the right to renew for ten or twenty years under certain conditions; in Quebec, Ontario and the Prairie Provinces the leases are all annual in form. In Quebec, it is stated that where the land is unquestionably non-agricultural the leases have, through custom, become practically perpetual and the government has announced that it will not change the terms oftener than once in ten years. In Ontario, the Crown has always contended that the leases were for one year only and that while it renews them from year to year on non-agricultural land, it can at any time terminate the lease by giving six months' notice. It has also announced that it will not alter its dues and ground rents oftener than once in ten years. Recent sales in Ontario have been by auction for a rate per thousand feet, board measure, of the standing timber. There are no dues or bonuses and the purchaser is given a limited time in which to take off the timber, after which the land reverts to the Crown.

British Columbia has recently made an elaborate revision of its system. By this revision most of the leases become perpetual but the government takes power to revise the terms every five years. These dues are fixed on a basal price for lumber at the mill. If at the end of any five year revision period the price shall have risen above this base price then the government will take an increased royalty or tax in proportion to the increased price.

All the governments make provision for fire protection and have called upon the lumbermen to pay an increasingly large proportion of the cost of this protection on lands leased to lumbermen; the governments, of course paying the whole cost of protection on the areas of forest land where the Crown has not yet parted with the right to cut the timber.

The policy of forest reserves, that is of land unsuited to agriculture set apart to grow timber for ever, is a recent development in Canada and the method of conducting operations on these reserves is one of the administrative problems now being worked out in this country.

## Methods of Canadian Lumbering.

All of Eastern Canada drains into the Atlantic through great lakes and rivers. The great forests were on the banks of these rivers and their tributaries. This was also largely true of British Columbia in respect to the Pacific, so that with comparatively small exceptions all of Canada's lumbering operations have been carried on by water. Under this system the trees are felled in the autumn and winter, drawn by horses to the rivers and

streams and piled on the ice which at that time covers the surface. When the rivers break up in the spring the freshet carries the logs with it out to the mouths of the rivers, where they empty into the great rivers like the St Lawrence or Ottawa or the great lakes like Huron or Ontario. Here the logs are boomed (1) and the logs of the different owners separated by means of the timber brands on the ends of the logs. The logs thus separated are sawn into boards and planks in the mills located along the river bank.

The practice is now prevalent of bringing the mills as close as possible to the forest and shipping out only the finished product, but in the early days the mills were located at lumber centres on the great rivers and the logs were formed into rafts and these rafts were floated down the rivers, run over rapids and towed across lakes to the mill. For many years the export trade consisted largely of square timber, that is timber squared by the axe in the woods. This trade, which employed many hundred sailing ships, had its centre at the port of Quebec, where sometimes as many as three hundred ships were to be seen loading at one time. It reached its highest point about 1870 and since that, owing to the wastefulness of the trade and the dangerous condition in which it left the woods, owing to the chips and debris, it has been attacked from both the commercial and legislative sides and had dwindled away to almost nothing.

Nowadays the steamer, schooner or barge carries the sawn lumber from the lake port or river town to the seaport where it is loaded on ocean-going ships. The method thus differs from those employed in the United States, where the transportation is largely done by logging railways. This water transportation feature with the risks and dangers attending the "driving" of the logs down the small streams and, attending the "booming" and "rafting" and "shooting" of rapids and running of "log-chutes", has bred up a hardy, adventurous class of men equally skilful in the use of the axe, the pikepole (2) and the paddle, and has developed a literature in prose and verse which has forever given a touch of romance to Canadian lumbering.

## The Forest Trees of Canada

by

R. G. LEWIS.

Coniferous forest growth prevails over the greater part of Canada's potential forest area. If we eliminate from our conception of potential forest

(1) "Boomed"; that is floated into great enclosures formed of floating logs chained together end to end and anchored to piers set in the river. As the logs float through a narrow entrance the river men or "log drivers" skilfully direct them into the enclosures of the different owners as indicated by the brands or marks on the logs.

(2) The pikepole is a pole fifteen or twenty feet long fitted with a sharp spike and hook at one end, which pole the river "driver" uses to balance himself as he walks along the floating, rolling logs, and to draw the logs into the desired channels or away from rocks.

that which grows on land fit for agriculture we eliminate most of the hardwood forests of commercial value. In the rigorous climate of Canada deciduous-leaved trees, as a general rule, are found in commercial sizes and quantities only on the better sites. Where coniferous forests are destroyed by fire or lumbering operations and deciduous-leaved trees, such as the birches and poplars, establish themselves by means of their light wind-borne seeds, the change is only a temporary one. The original coniferous forest will eventually re-establish itself by its more persistent growth.

In Canada there are approximately 150 different species and varieties of trees. Only 32 of these are conifers but the wood of these forms 95 per cent of our forest products, and the trees themselves cover an even larger proportion of our potential forest area.[1]

While the actual number of species of deciduous-leaved trees seems large in comparison to their commercial importance, out of a total of some 118 species and varieties, only four or five are worthy of comparison with the conifers. The others form the northernmost fringe of the great interior hardwood forest type of the United States. Many of these species are confined in Canada to a narrow strip of territory along the north shore of Lake Erie and as far as the discussion of Canada's timber resources are concerned they may be classed with exotic tree growth.

The five native spruce species are all of commercial importance. Spruce lumber formed over one third of the total output of Canadian sawmills in 1914. Spruce pulpwood is used in preference to all others and in the same year formed over two thirds of the total quantity of pulpwood consumed in Canadian pulpmills and exported in the raw or unmanufactured state. The wood has a long, tough, colourless fibre and being free from resin is considered to be the best material for pulp manufacture on the market of the world.

Spruce is also used for railway ties or sleepers, telegraph, telephone and electric light and power line poles, cooperage, mining timbers, fencing and firewood. Of the five native spruce species the white spruce (*Picea canadensis*) is the most abundant and the most important commercially. With black spruce (*Picea mariana*) it ranges from Labrador to Alaska, extending northward almost to the limit of tree growth and southward into the United States. Toward the northern limits of its distribution the tree, of course, does not reach commercial size being in many cases little more than a prostrate shrub.

The black spruce (*Picea mariana*) is of less value, being a smaller, slow-growing tree, often confined to swampy situations and reaching saw log or pulpwood sizes only under more favourable conditions of growth. The red spruce (*Picea rubra*) is confined in its distribution to the Province of Quebec and the Maritime Provinces. Its wood is considered to be of greater technical value than that of the other spruce species, but it is not usually so abundant on the market as the white spruce. The western species (*Picea Engelmanni* and *Picea Sitchensis*) are not found east of the Rocky Mountains and their utilization is confined to the Province of British Columbia, they being essentially Pacific Coast trees. Their wood is of high technical

value and can usually be obtained in larger dimensions than that of the other spruces, as the trees attain great size in this region.

As their distribution is restricted and as they are found growing with trees of greater commercial value, their lumber does not assume great national importance at the present time.

There are nine distinct pine species native to Canada, and of these, six are of great commercial importance. The eastern white pine (*Pinus Strobus*) is the most valuable coniferous wood in Canada. It has superior qualities for the wood worker and enjoys a world wide reputation. Up to a few years ago it was the most important wood in Canada in point of quantity of lumber sawn and exported in the form of square timber (Quebec pine). Owing to increased scarcity of good material the wood has fallen off in production till its place has been taken at the head of the list by the spruces, of which there is a greater supply of available material. The wood of white pine is soft, easy to work, fairly durable and strong in comparison to its weight. Its most valuable quality in addition to these is its faculty for holding its shape with a minimum of shrinking or swelling once it has been properly seasoned. In this latter respect there are a few woods of commerce that can surpass it. The western white pine (*Pinus monticola*) is similar in most respects to the eastern species. It is a smaller tree, of comparatively rare occurrence and is of minor commercial importance. In distribution it is confined to the province of British Columbia while the eastern white pine is found from eastern Manitoba to the Atlantic seaboard. The remaining pine species are sometimes classed as "hard pines", their wood being harder and more resinous than that of the "soft" or white pines. The red or Norway pine of eastern Canada and the western yellow or "Bull" pine of the interior of British Columbia (*Pinus resinosa and ponderosa*) are valuable sources of light structural timber and are also sawn into lumber. The two jack pines (*Pinus Banksiana* of the east and north and *Pinus Murrayana* of the Rocky Mountains and British Columbia) are not considered as valuable timber producing trees although they are both used locally for rough construction. Jack pine railway ties are used to an enormous extent on the newly constructed transcontinental railway lines as the wood is handy to the right-of-way and can be obtained in sufficient quantity with a minimum of haulage. In 1914 over forty per cent of the ties used in Canada were of this wood. Its cheapness and abundance are its most important characteristics in this respect. In the manufacture of "Kraft" pulp by the sulphate process it has been found that jack pine is a satisfactory raw material and the use of the wood for this purpose has increased in the last few years very greatly. There are three other species of the genus Pinus that reach tree size in Canada, but these are only of local importance for firewood.

The Douglas fir (*Pseudotsuga mucronata*) often erroneously called "Oregon Pine", of British Columbia and the Pacific Coast is the only representative of its genus in Canada. It yields more lumber annually than any other single species in America. The cut in Canada represents over 15 per cent of the total lumber production. The tree in Canada is not found east of the Rocky Mountains, the greater part of the lumber being obtained

in the Coast Region of British Columbia. This is Canada's largest tree and from it larger timbers can be obtained than from any other tree in America, with the single exception perhaps of the California Redwood (*Sequoia*). Up to the present time its use has been largely confined to structural purposes but its attractive grain and figure are winning for it popularity as a wood for more decorative purposes such as interior finish and cabinet work. The wood comes fourth in importance in Canada as a material for railway ties and is used extensively for mining timbers. It is noted chiefly for its strength and durability and the dimensions in which it can be obtained.

There are three hemlock species in Canada's forests, two of which are valuable timber trees. The eastern hemlock (*Tsuga canadensis*) is abundant throughout its range in the eastern provinces, but is not found west of the province of Ontario.

The wood is used chiefly for rough, cheap construction especially house framing. It is fairly strong but has many objectionable features from the woodworker's standpoint, being rough, harsh, splintery, and difficult to work. It is not durable in contact with moisture but supplies the demand for a cheap, strong material for many purposes. The wood is also used for railway ties, poles, mining timber, pulpwood and firewood. Its bark is a valuable source of tannin. The western hemlock has few of the objectionable technical features of its eastern relative. This tree (*Tsuga heterophylla*) is found in Canada only in the province of British Columbia, and is becoming more valuable each year as the prejudices due to its name are overcome. The two trees in Canada in 1914 yielded over eight per cent of the total lumber production of the country.

There is only one balsam fir in eastern Canada (*Abies balsamea*). The tree is found from Labrador to Alaska covering practically the same geographical distribution as the white and black spruces. Its wood is sawn into lumber to take the place of more valuable woods for rough construction as it has few technical qualities which would recommend it for any other use as lumber. The purpose for which the wood of this tree is best suited is in the manufacture of wood pulp for paper making. The tree, in nature, occurs mixed with spruce and it is cut and marketed with that wood. Balsam fir has the requisite length and toughness of fibre for pulp making and in spite of the fact that it gives a slightly lower yield of pulp per cord and contains a higher percentage of resin than spruce its use is increasing. In 1914 one fourth of the pulpwood cut was of this species.

There are three western balsam fir species whose wood is very similar to that of *Abies balsamea*. The most important of these at present is probably the Alpine fir (*Abies lasiocarpa*). Where these western species are utilized their wood is put to similar uses to those of the eastern species. They are confined in their distribution to the Rocky Mountains and the Pacific Slopes.

There are only two species of the genus *Thuya*, commonly called "Cedar" in Canada. They are both of great commercial importance, each in its own region, as their ranges do not overlap. The wood of the cedars

is the most durable of the conifers of the Dominion. The eastern tree; white cedar (*Thuya occidentalis*) is found from the Atlantic to the south-eastern part of Manitoba. It does not extend as far north as some of the other conifers and is nowhere very plentiful, being confined to moist situations. The wood has become so scarce in Eastern Canada that the supply is not equal to the demand and the market for a light, durable wood is being partly filled by imported cypress (*Taxodium distichum*) from the southern United States. Cedar is preferred to all other native woods for shingles and all structural work exposed to moisture. In spite of the fact that the wood is not strong, its great durability in contact with the soil makes it a valuable railway tie material. In 1914, this wood came second on the list for railway ties purchased by Canadian railways. It is used in enormous quantities both locally and for export for fence-posts and its use for this purpose is largely responsible for the increased scarcity of the lumber, as young trees are used before they have time to reach saw log sizes. The western red cedar (*Thuya plicata*) is one of the giants of the Pacific Coast, being only surpassed in size by Douglas fir. Its wood is sawn into lumber of large dimensions and is made into shingles to a greater extent than any other wood in Canada.

Birch is Canada's most important hardwood and one of the few woods of this class where the exported material exceeds that imported. There are at least seven native species but only two are worthy of any detailed discussion. The yellow birch (*Betula lutea*) is the source of the most valuable birch lumber used for flooring, furniture, cabinet work and vehicle stock. The tree grows only in Ontario, Quebec and the Maritime Provinces and does not reach commercial dimensions north of the height-of-land between the St. Lawrence River and Hudson Bay. Its wood is hard, heavy, strong and tough but is not durable in contact with moisture.

The paper birch (*Betula alba* var. *papyrifera*) has a much wider distribution and is more abundant in its range, being common from the Atlantic to the Rocky Mountains. Its wood is softer, weaker and less durable than the yellow birch and is not at present of great commercial value. It is usually considered as a " weed tree ", as it springs up with marvelous alacrity on burned-over or cut-over areas. It has certain qualities of toughness and compactness which will in time win it a place among our more important woods when these qualities are better understood. The tough, resinous bark of this tree has supplied the aborigines for centuries with the material for covering their famous " birch bark canoes ".

Of the three native tamarack or larch species, two are worthy of note. The eastern tamarack (*Larix laricina*) is found in every province in the Dominion in swampy situations. Its wood is hard, strong and durable, being similiar to that of Douglas fir and the Southern hard pines. The western larch (*Larix occidentalis*) is more important commercially. It is found only in British Columbia but grows on better sites and reaches greater size than the eastern tree. The wood of these two species together is cut into lumber and also used for railway ties, coming third on the list in 1914, and for mining timbers and fencing.

The maple, whose leaf is the national emblem of Canada, is our second most important hardwood and is represented in Canada by nine or more species scattered from the Atlantic to the Pacific. Only one species however can be considered here. The sugar maple or hard maple (*Acer saccharum*) produces the most valuable lumber and, like birch, is used for furniture, vehicle stock and interior house finishing. The sap of this tree is the source of maple syrup and sugar.

Basswood (*Tilia americana*) is a valuable wood for cabinet work of all kinds but being restricted in distribution and in great demand the available supply has almost disappeared, It formed less than one per cent of the lumber produced in Canadian sawmills in 1914.

Elm, represented by three species in Canada, is a valuable vehicle wood. Beech, ash, oak, butternut, chestnut, hickory, cherry, black walnut, tulip, black gum, red alder, sycamore and sassafrass are all valuable woods and are still sawn into lumber in Canada, but in most cases the supply, which was never large, has dwindled almost to insignificance.

The poplar species, of which there are seven native to Canada, are for the most part considered as "weed trees" but, like paper birch and jack pine they produce great quantities of material which will eventually become valuable at least for some purpose when their qualities are better appreciated and when the scarcity of the more valuable of better understood woods will make their careful utilization imperative.

The following is a list of the important tree species of Canada and some of the minor ones. The nomenclature is in accordanc with GRAYS'S BOTANY and the common names given are those used by the Forestry Branch of the Department of the Interior. These latter names have been chosen with the the idea of conforming as closely as possible with names in common use by lumbermen and foresters in Canada but where duplication of names has given rise to confusion the most suitable name has been chosen.

## CANADIAN TREE SPECIES.

### I.—Conifers.

| | |
|---|---|
| *Pinus Strobus* | White pine |
| » *monticola* | Western white pine |
| » *flexilis* | Limber pine |
| » *albicaulis* | White-barked pine |
| » *ponderosa* | Western yellow pine |
| » *rigida* | Pitch pine |
| » *resinosa* | Red pine |
| » *Murrayana* | Lodgepole pine |
| » *Banksiana* | Jack pine |
| *Larix laricina* | Tamarack |
| » *occidentalis* | Western larch |
| » *Lyallii* | Alpine larch |
| *Picea Mariana* | Black spruce |
| » *rubra* | Red spruce |
| » *canadensis* | White spruce |
| » *Engelmanni* | Engelmann spruce |

| | |
|---|---|
| » *sitchensis* | Sitka spruce |
| *Tsuga canadensis* | Hemlock |
| » *heterophylla* | Western hemlock |
| » *Mertensiana* | Black hemlock |
| *Pseudotsuga mucronata* | Douglas fir |
| *Abies balsamea* | Balsam fir |
| » *amabilis* | Amabilis fir |
| » *grandis* | Lowland fir |
| » *lasiocarpa* | Alpine fir |
| *Thuya occidentalis* | Cedar |
| » *plicata* | Western cedar |
| *Chamæcyparis nootkatensis* | Yellow cypress |
| *Juniperus communis* | Juniper |
| » *virginiana* | Red juniper |
| » *scopulorum* | Rocky Mountain juniper |
| *Taxus brevifolia* | Western yew. |

## II. — Hardwoods.

| | |
|---|---|
| *Juglans cinerea* | Butternut |
| » *nigra* | Black walnut |
| *Carya cordiformis* | Bitternut hickory |
| » *ovata* | Shagbark hickory |
| » *alba* | Mockernut hickory |
| » *glabra* | Pignut hickory |
| *Populus tremuloides* | Aspen |
| » *grandidentata* | Large-toothed aspen |
| » *balsamifera* | Balsam poplar |
| » *angustifolia* | Narrow-leafed cottonwood |
| » *acuminata* | Lance-leafed cottonwood |
| » *trichocarpa* | Black cottonwood |
| » *deltoides* | Cottonwood |
| *Salix* sp. | Willow |
| *Carpinus caroliniana* | Blue beech |
| *Ostrya virginiana* | Ironwood |
| *Betula lenta* | Sweet birch |
| » *lutea* | Yellow birch |
| » *populifolia* | White birch |
| » *alba* var. *papyrifera* | Paper birch |
| » *occidentalis* | Western birch |
| » *alaskana* | Alaska birch |
| » *fontinalis* | Mountain birch |
| *Alnus sitchensis* | Sitka alder |
| » *oregona* | Oregon alder |
| » *tenuifolia* | Mountain alder |
| » *incana* | Spreckled alder |
| *Fagus grandifolia* | Beech |
| *Castanea dentata* | Chestnut |
| *Quercus rubra* | Red oak |
| » *palustris* | Pin oak |
| » *coccinea* | Scarlet oak |
| » *velutina* | Black oak |
| » *alba* | White oak |

| | |
|---|---|
| » *Garryana* | Garry oak |
| » *stellata* | Post oak |
| » *macrocarpa* | Burroak |
| » *bicolor* | Swamp white oak |
| » *prinoides* | Dwarf Chinquapin oak |
| » *prinus* | Chestnut oak |
| » *Muhlenbergii* | Chinquapin oak |
| *Ulmus americana* | White elm |
| » *racemosa* | Rock elm |
| » *fulva* | Red elm |
| *Celtis occidentalis* | Hack berry |
| *Morus rubra* | Red mulberry |
| *Magnolia acuminata* | Cucumber tree |
| *Liriodendron tulipifera* | Tulip tree |
| *Asimina triloba* | Papaw |
| *Sassafras variifolium* | Sassafras |
| *Hamamelis virginiana* | Witch hazel |
| *Platanus occidentalis* | Sycamore |
| *Pyrus americana* | Mountain ash |
| *Amelanchier canadensis* | Service berry |
| » *spicata* | Saskatoon |
| *Cratægus* sp. | Hawthorn |
| *Prunus nigra* | Canada plum |
| » *pennsylvanica* | Bird cherry |
| » *emarginata* | Bitter cherry |
| » *virginiana* | Choke cherry |
| » *demissa* | Western choke cherry |
| » *serotina* | Black cherry |
| *Cercis canadensis* | Red bud |
| *Gymnocladus dioica* | Kentucky coffee tree |
| *Rhus typhina* | Staghorn sumach |
| *Acer spicatum* | Mountain maple |
| » *pennsylvanicum* | Striped maple |
| » *macrophyllum* | Broad-leaved maple |
| » *circinatum* | Vine maple |
| » *Douglasii* | Dwarf maple |
| » *saccharum* | Sugar maple |
| » *saccharinum* | Silver maple |
| » *rubrum* | Red maple |
| » *Negundo* | Manitoba maple |
| *Tilia americana* | Bass wood |
| *Nyssa sylvatica* | Black gum |
| *Cornus florida* | Flowering dogwood |
| » *Nuttallii* | Western dogwood |
| *Arbutus Menziesii* | Madrona |
| *Fraxinus quadrangulata* | Blue ash |
| » *nigra* | Black ash |
| » *americana* | White ash |
| » *pennsylvanica* | Red ash |
| » *pennsylvanica* (var. *lanceolata*) | Green ash |
| » *oregona* | Oregon ash |

SECOND PART.

# ABSTRACTS

## AGRICULTURAL INTELLIGENCE

### GENERAL INFORMATION.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

956 – **The Agricultural Products of Portuguese Guinea.** — Machado da Fonseca Joaquim., in *Revista Agronomica*, XIth year (2nd Series), Vol. 2, Nos. 13-16, pp. 43-81, 1 diagram + 1 map. Lisbon, 1915.

Report on a voyage of agricultural exploration carried out with a view to organisation of the colonial agricultural services in the province of Portuguese Guinea, by the order of the Portuguese Government, together with replies to a detailed list of questions prepared by the Government of the Colony and the General Direction of Colonies.

Soil. — The cultivable soils of this province are generally clayey-humous-limestone. They are sometimes, but rarely, richer in clay; others of them again (those of Cachen) are rather sandy. Being generally very fertile, they need no manuring, and are admirably adapted for the intensive cultivation of all tropical plants. From 10 analyses of soils made at the superior Agronomic Institute at Lisbon the following data representing extremes are obtained :

*Composition of Soils in Portuguese Guinea.*

| | ‰ | | ‰ |
|---|---|---|---|
| Fine earth | 958-1000 | Nitrogen | 0.98-2.5 |
| Moisture | 12- 48 | Phosphoric acid | 1.47-3.9 |
| Organic matter | 32- 146 | Potash | 0.5-1.72 |

The predominating cultivations are the following :

Cereals. — Rice and maize form the bases of native foods. Mountain rice is cultivated on the following method : after the first rains all the weeds are pulled up and burnt, the ashes spread over the land, the latter

being given a superficial cultivation, the seed is sown broadcast, and weeding is continued until harvest. Paddy is treated in the following manner: from the end of May to June the seeds are sown; the plantlets are transplanted one by one when they have reached a height of 6 to 8 inches; the rice field is kept free from weeds and is flooded. With the weeds which have been pulled up and afterwards stacked small dykes are made. The crop is got in from December to March. To sow 1 acre, from 11 ½ to 12 bushels of rice are used. The average crop is from 44 ½ to 47 bushels per acre. The market price is 1*s.* 2 ½ *d.* per gallon for the paddy, and 1 *s.* 7 ½ *d.* per gall. for the rice not in husk. There are also grown: *Zea Mays, Pennisetum typhoideum, Andropogon Sorghum,* etc.

Leguminous Crops. — Beans are chiefly grown.

Starch Crops. — Sweet and bitter cassava and the sweet potato are chiefly cultivated.

Textile Plants. — The cotton plant is grown, though to a limited extent, in the regions of Farim, Bolama, Bafatà, Buba and Cacine in consequence, undoubtedly, of a distribution of seeds made some years ago by the Government. In the region of Farim, the writer observed specimens of *Gossypium herbaceum* and *G. barbadense* of excellent growth and abundantly productive. With the cotton the natives manufacture certain articles for their personal use.

Crops yielding Oil. — *Arachis hypogea* in cultivated to a large extent on the following method: After the first rains, that is from the end of May to the month of July, the soil is superficially dressed, after which sowing is done in rows at the rate of 40 to 44 ½ lbs. of seed per acre, the seed being afterwards covered. The crop is taken off from December to March. The average unit production is 1 340 to 1 600 lbs. per acre. The average selling price on the market is 0.73 *d.* per lb. The ground nut is not cultivated by the natives alone, but also on lands granted to whites. *Sesamum indicum* is used, but is not cultivated.

The trees or shrubs producing oil seeds or fruits are: *Elaeis guineensis, Carapa Touloucouna, Ricinus communis,* and, in addition, a shrub termed by the natives "arcus", etc. *Elaeis guineensis* forms very extensive forests. It is not very productive however (13.2 lbs of kernels and 0.66 gallons of oil per tree), and is poor in growth owing to the incisions made with the object of extracting the sap, with which palm wine is manufactured. The exportation of coconuts is carried on to some small extent, but could be very much extended.

Rubber Plants. — The wild rubber producing plants (*Landolphia Hendelottii* and *L. senegalensis*) are utilised direct by the natives in the regions of Farim and Batafà. The latex is gathered from November to May, by the use of primitive and destructive methods, namely, by incision, removal of the bark or felling of the trees. It is coagulated by leaving it exposed to the air in the presence of salt and tamarind juice which is found in abundance. It is dried in the sun, then shaped into balls and sold in this form. The dried rubber fetches 3 *s.* and the "green" rubber 1 *s.* 5 *d.* per lb. There are no rubber plantations in the true sense of the word. The

rubber is exported from Portuguese Guinea to Hamburg, Marseilles and Havre. In 1912 there were exported 500.300 lbs. of a declared value of some £ 79 410. The writer believes that by prohibiting the burning of the wood and teaching the natives the use of a more rational method in gathering and coagulating, this production could be greatly increased and improved.

Stimulating and Narcotic Plants. — *Coffea arabica* and *C. liberica* grow in the regions of Bolama, Buba and Cacine; *Theobroma Cacao* at Bijagós; *Sterculia acuminata* at Cacine. These plants thrive excellently but produce little owing to complete absence of cultivation. Recently the " Companhia Commercial Agricola dos Bijagós " began cocoa cultivation by means of imported seeds. The results hitherto obtained justify hopes of great success.

Sugar Plants. — The sugar-cane is cultivated in the regions of Farim and Batafà, which, according to the writer, are best adapted for this cultivation. The mean annual temperature there is from 77 to 78.8° F. The rainy season occurs between May and October, and for the rest of the year the weather is dry; the lands are chiefly low and moist, of clayey humus-limestone composition. Several navigable streams can supply non-brackish water for irrigation, and also serve as easy and cheap ways of communication. The population is sufficiently dense to furnish the necessary labour. In the plantations, all of which are conducted by settlers, the sugarcane cuttings are generally planted at 20 inches distance in furrows 15 $^3/_4$ to 23 $^1/_2$ inches wide and 12 to 20 inches deep, 3 ft. 3 in. to 4 ft. 11 in. apart. For multiplication the best shaped canes, still green, are selected. The middle part is reduced to fragments which are placed aslant in the furrow. The sowing work is carried out from March to May, and no manure is used. The after-management consists in weeding and keeping the irrigation ditches clear. This is a system which may be described as natural, because the sugar cane is grown along the rivers. The waters of the latter are forced up once a day by high tide, and rise to such an extent as to fill the irrigation ditches, which are arranged perpendicularly to the bed of the streams in question. Eight months after sowing, the cane is ripe. The crop is gathered from December to May. The plantation is renewed every 3 years, that is, after 3 crops. No sugar is manufactured. The whole of the cane grown is devoted to the production of alcohol. The juice yield of the cane is 48.5 % and the sugar yield 13%. This region is admirably suited for sugar-cane growing, but is cultivated by 15 settlers only over a total area of 84 acres. The natives do not carry on this cultivation. In 1913, 790 675 lbs. of sugar were imported into Portuguese Guinea.

Horticulture. — Many green vegetables are cultivated, which grow with surprising rapidity.

Arboriculture and Sylviculture. — Among the most common fruit trees, the writer mentions: *Anacardium occidentale*, the pine-apple, *Psidium Guajava* (cultivated), orange, lemon, *Carica Papaya*, all cultivated, then: prickly pears, tamarind, banana and *Zizyphus Jujuba*, utilised, but not cultivated.

The regions of Farim and Batafà are exceedingly rich in timber trees, such as: *Swietenia Mahogani*, *Hasskarlia didymostemon*, *Milletia* spp. ("pau ferro"), *Dalbergia melanoxylon*, *Bombax* spp., *Borassus flabellifer* (of which the fibres are also utilised), *Adansonia digitata*, the fruit of which is medicinal, etc.

957 - **Agricultural Education in Chile. — The Agronomic Institute of Santiago.** — VALDIVIA URBINA, in *La Vie agricole et rurale*, VIth year, No. 26, pp. 465-466. Paris, June 24, 1916.

AGRICULTURAL EDUCATION

In 1842, under the auspices of the *National Society of Agriculture* there was founded in Chile the first practical School of Agriculture, the direction of which was entrusted to a Spanish specialist, DON MANUEL DE ARANA BORICA.

Having been reorganised later on by an Italian scientific agriculturist, DON LUIS DE SADA, it was established on a fine farm covering more than 330 acres situate on excellent alluvial soil about 10 feet deep, the said farm having been bought by the Government from General DON MANUEL BULNES, on the very outskirts of Santiago, the capital of Chile.

This institution was organised on the model of the European schools of agriculture, and was given the name of *Quinta Normal*, "Normal Farm".

Higher agricultural education began in 1873, by the creation, in the University, of a Chair of agriculture occupied by an agricultural engineer from Grignon, a Frenchman, M. LE FEUVRE; there was afterwards created a chair for the science of livestock-breeding etc., which was filled by another French agricultural engineer, M. JULES BESNARD.

In 1874 there was founded at the *Quinta Normal* an establishment for higher agricultural education which assumed the name of "agronomic Institute", and of which Messrs. LE FEUVRE and BESNARD undertook the direction.

After numerous exhibitions organised by the *National Society of Agriculture*, and which afforded a clear view of the progress achieved in the agricultural department, the Ministry of Public Works created a department for the Promotion of Agriculture and the Inspection of Agricultural Education.

At the present time, all the agricultural Services are under the Ministry of Public Works and subject to supervision by the Inspection service just mentioned, except with regard to the Forest Inspection Department created recently, which is directly subordinate to the Ministry of Public Works.

These services comprise:

An Office of Agricultural Statistics; the Agronomic Institute of Santiago; five Practical Schools; a Station of scientific Agriculture, Oenology, Plant Pathology, and Meteorology; a Veterinary Hospital; four Services of Regional Agricultural Engineers, who play a part similar to the French departmental professors.

The area occupied by the "Quinta Normal" of Santiago is divided as follows (1 hectare = nearly 2 ½ acres).

| | Hectares | Ares | Centiares |
|---|---|---|---|
| | — | — | — |
| Park land | 26 | 93 | 13 |
| Glass houses and winter gardens | — | 49 | 33 |
| Experimental fields | — | 35 | 78 |
| Zoological garden and Veterinary hospital | 2 | 31 | 95 |
| Pleasure garden | 1 | 24 | 58 |
| Kitchen and Fruit garden | 2 | 34 | 90 |
| Fruit tree nurseries | — | 26 | — |
| Orchard | 1 | 77 | 20 |
| Forest and ornamental trees | 5 | 6 | 65 |
| Vineyard | 20 | 97 | 59 |
| Practical schools and plots annexed | 2 | 68 | 41 |
| Stables and sheds | — | 65 | 82 |
| Groves, thickets, etc. | 2 | 59 | 4 |
| Annual forage plants | 8 | — | — |
| Temporary grassland | 22 | — | — |
| Grain crops | 6 | — | — |
| Weeded crops | 3 | 6 | — |
| Industrial plants | 4 | — | — |
| Gardens for Live-stock shows | 2 | 31 | 50 |
| Botanical gardens | 2 | 70 | 27 |
| Astronomical observatory | 1 | 69 | 1 |

The object of the Institute is to train up : farmer landowners or managers possessing the necessary scientific knowledge for the best working of the soil: technical managers for agricultural industries ; directors for the public departments connected with agriculture ; professors and assistants for agricultural education at the Institute itself and in the practical schools.

Students are admitted after a competition from which only bachelors of science are exempted. Candidates must be seventeen years old at least.

The period of study is four years, after which those students who have maintained a sufficient average standard receive the diploma of Agricultural Engineer.

The school year begins in March and ends in December.

The Institute, in addition to regular students, admits free students desirous of following a special course in one subject ; the duration of their stay in the Institute is limited to two years.

Education is entirely free, as is indeed the case in all educational establishments in Chile.

It comprises the following courses :

1. General agriculture : (*a*) agricultural climatology ; (*b*) study of soils, manuring and manures ; (*c*) plant reproduction.
2. Special agriculture : (*a*) agricultural work ; (*b*) cultivation of food plants, industrial plants and grasslands.
3. Arboriculture for forest, fruit and ornamental trees, and horticulture.
4. Vine-growing and wine-making.
5. Plant physiology and micrography.
6. Plant pathology and agricultural entomology.
7. Sylviculture.
8. Applied organic chemistry.
9. Agricultural chemistry.
10. Analytic chemistry (quantitative).

11. Animal anatomy and physiology.

12. Elements of veterinary medicine: (*a*) pathology and pathological anatomy; (*b*) materia medica; (*c*) veterinary clinic.

13. Livestock: (*a*) external structure of animals; (*b*) general science of livestock; (*c*) applied zootechny; (*d*) forage and rational feeding of cattle; (*e*) poultry-keeping, bee-keeping and silkworm-rearing.

14. Farm engineering: (*a*) surveying, levelling, general mechanics, agricultural mechanics (agricultural machinery and motors); (*b*) hydraulics (irrigation, drainage, etc.); (*c*) farm buildings, geometric drawing, freehand drawing, topographical and mechanical drawing.

15. Agricultural industries (technology) comprising the industries of greatest interest to the country: (*a*) manufacture of alcohol; (*b*) dairy industry; (*c*) food preserves; (*d*) textile material, etc.

16. Applied hygiene.

17. Rural and *consular* legislation.

18. Economics, farm accounts and consular information.

For demonstrations and practical applications of the courses, the Institute possesses, in addition to a library of 6,000 volumes, which receives a large number of agricultural publications, a museum of agricultural products, appliances and machinery. Important annexes are made up of:

Experimental field. Weather observatory. Laboratories of: technology, with models of technological plant; agricultural chemistry; plant botany and pathology; seed tests and agricultural distillery. Dairy serving both for cheese and butter making. Vineyard with wine store and wine cellar. Vine nursery. Orchard. Kitchen garden. Hot-house for plant propagation. Section for fruit, forest and ornamental shrubs. Section for the growing of the principal plants under field conditions (industrial, food and forage). Section concerned with domestic animals for breeding and farm work. Stud animal section. Byre for livestock experiments and a veterinary hospital.

From the second year onwards the courses are supplemented by visits to farms, factories of agricultural products etc., in which the students are accompanied by the professors and assistants.

The costs of these excursions are defrayed by the Government, which appropriates a special credit for that purpose every year and places first-class tickets at the disposal of the Institute.

Every year the Institute organises an excursion of one month for fourth year students, with the object of making them acquainted with the different agricultural regions of the country and their special qualities.

The State, on that occasion places at the disposal of the students a first class carriage, one half of which is converted into a sleeping-car, and an ordinary carriage converted into a kitchen and restaurant car, which carriages can be hooked on to any train.

The students are put through monthly examinations and general examinations at the end of each school year. Those among them who have secured a sufficiency of marks at the general examinations in the previous years undergo a final general examination at the close of the fourth year.

They are furthermore required to produce a report proving that they have been through a probationary period on a farm. Every year the students who have passed their graduation examination are sent on a mission abroad at the Government expense.

958 - **Reorganisation of Agricultural Education in Colombia.** — *Revista agrícola, Organo del Ministerio de Agricultura y Comercio*, IInd Year, No. 2, p. 65. Bogota, February 1916.

Decree No. 123 of the 31st January 1916 provides for the reorganisation of the National Agricultural and Veterinary Institute under the name of " Instituto nacional de Agronomía ". The following are to form part of the National Agronomic Institute : the practical schools of Agriculture, the stations of scientific agriculture and experimental fields, founded in the capital or in other localities of the Republic. The director of the School and the technical chiefs of the experimental services of the Station of scientific agriculture will form the technical Council of the corresponding Station which must reply to enquiries by the Ministry of Agriculture and Commerce, as well as to those of the public, on questions of scientific agriculture, livestock and protection of plants against diseases and pests.

## CROPS AND CULTIVATION.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

959 - **Contribution to the Study of the Forms in which Phosphoric Acid occurs in the Soil.** — Jegorov M. A., in *Южно-русская сельско-хозяйственная Газета* (*The Agricultural Gazette of Southern Russia*). Nos. 13-14 and 15, pp. 4-5 ; 4-5. Kharkov, April, 1916.

In the study of the problem of the phosphoric acid of the soil, the question of the forms in which it occurs is fundamental, and by a knowledge of them we may attain to a solution of the important problem of the dynamics of soluble phosphoric acid in the soil in relation to the cultivable conditions of this latter. Starting out from this idea, the above writer, together with J. J. Stozkij and P. P. Gretchianinov, conducted experiments with a view to determining the quantity of organic phosphoric acid contained in " podzol " and " tchernoziom " earths.

The investigators adopted the following method of separation, which perfectly well answers the purpose, as was shown by 2 years of work ; the earth, first washed with 3 % hydrochloric acid, is afterwards treated with a 3 % solution of ammonia. The resulting solution is passed through porous filters, and the filtrate precipitated with acetate of lead. The precipitate is carefully washed, treated with sulphuretted hydrogen to eliminate the lead, and dissolved again in dilute ammonia. It is then filtered, the filtrate is concentrated and afterwards treated with ether, which separates the organic combination of phosphorus which it is proposed to study from the mineral phosphoric compound which might be present.

The soils used for these experiments were : " Podzol " from the farm of the Agronomic Institute of Moscow, with an average of 0.0532% of phosphoric acid ; the " tchernoziom " of the government of Kursk, with an average of 0.110 % ; and " tchernoziom " of the government of Ufa, with an average of 0.145 %. The ammoniacal solutions contained respectively : 52.7, 55.18 and 30.41 % of the total phosphoric acid of these earths, in other words, about one half in the case of the first two, and one third in the last.

The workers succeeded in obtaining considerable quantities of organic phosphoric acid. In one case it represented 17.67 % of the total phosphoric acid content of the soil, and in another, 10 %. There is reason to believe that higher percentages would be obtained in proportion as the method applied to this investigation is improved.

By these means, in the "podzol" and "tchernoziom" the presence of a considerable proportion of phosphoric acid in the form of an organic combination which appears to be one of the nucleinic acids was definitively established. The ascertainment of this fact does not yet furnish the required answer to the question of the dynamics of phosphoric acid in the soil. Nevertheless, in view of the fact that J. J. STOZKIJ succeeded in proving that with 3 % hydrochloric acid not only mineral but also organic phosphoric acid is extracted from the soil, and that probably a substantial proportion of this mineral phosphoric acid in the hydrochloric solution is not of mineral but of organic origin, and that it becomes mineral in the process of evaporation of this solution, then the importance, not merely theoretical but also practical, of investigations of this kind will become clearly evident. Bearing this in mind, and also the fact that the best results on "tchernoziom" are obtained by means of phosphate manure in spite of the richness of that soil in phosphoric acid, the writer suggests the possibility of overcoming the condition of inertia of the large stores of phosphoric acid contained in the soil by a knowledge of the dynamics to which its presence therein is subject.

Finally, it may be presumed that the organic combinations of phosphorus differ according to the soils, and it is highly desirable that investigators should in a greater degree devote their attention to this point.

960 – **Method of Sterilisation and Chloroforming of the Soil in the Study of the Properties of "Tchernoziom".** — SKALSKIJ S. in *Южно-русская сельско-хозяйственная Газета* (*The Agricultural Gazette of Southern Russia*), Year XVIII, Nos 1; 2; 5; 7 and 9; pp. 7-8; 6-7; 5-7; 9-10. Kharkov, January-February-March 1916.

On the basis of his experiments carried out in the laboratory of bacteriological chemistry of the agricultural experiment Station of Ploty (Russia) the writer proves that under the influence of fertilisation and chloroforming the fertility of the tchernoziom increases. He ascertains the degree of such increase, and, to the extent permitted by the results obtained, explains the modifications which take place in the sterilised and chloroformed tchernoziom and which produce the increase in its fertility. The experiments were conducted in the following way :

Small WAGNER vessels to the number of two for each experiment were filled with tchernoziom, under different conditions of cultivation : 1) an April fallow (that is, fallow ploughed in April) ; 2) a soil cleared several years since ; and 3) a 3 year-old lucerne soil. From each of these soils two layers were taken, namely the arable (from 0 to 17.7 cm. deep) and the layer immediately below (from 17.7 to 35.5 cm. depth). With the samples of soil mentioned 6 set of vessels were filled. The vessels of the first series, which were to serve as controls, were filled with the normal soil, that is to say neither sterilised nor chloroformed ; those of the second series, by

which it was proposed to determine the content of assimilable phosphoric acid, were filled with samples manured with potassium nitrate and magnesium sulphate ; and those of the third, which were for the purpose of ascertaining the content of assimilable nitrogen, contained samples manured with acid potassium phosphate ($KH_2PO_4$) and sulphate of magnesia; those of the fourth received a complete mineral manuring, that is to say: potassium nitrate, acid potassium phosphate and magnesium sulphate ; in the vessels of the fifth series the sterilised earth was put, and in those of the sixth the chloroformed earth.

The sterilisation of the soil was carried out in vessels placed in an autoclave where they were subject to sterilisation by steam for one hour at a pressure of 2.5 atmospheres.

After cooling, the specimens sterilised in this way were watered with sterilised water to the *optimum* point of humidity.

The chloroforming was carried out by placing the corresponding samples in bottles with ground stoppers and adding to each sample 50 cc. of chloroform. After they had been left for three days in the bottles the samples were taken out, and, when the chloroform had completely evaporated, were placed in the vessels. The vessels having been prepared in this way, oats were sown in them, after the seeds had been previously treated with an 0.2 % solution of formalin and washed with distilled water ; the seeds were then germinated in an incubator. In each vessel 8 seeds were put ; after germination only the four most vigorous plants were left.

During the entire period of growth, the plants were watered with rain water to the *optimum* of humidity, the water being supplied from below by means of a special tube fitted to each vessel. The results of the experiments as regards the fertility of the tchernoziom in the 6 series of specimens studied are summarised in the accompanying table.

This table contains no particulars as to the effects of the sterilisation of the layer immediately below the arable layer (from 17.7 to 35.5 cm in depth) nor of the cleared land, or the lucerne soil, because on the sterilised samples of these soils the plants died in the course of their period of growth. The writer partly discerns the causes of this phenomenon in the fact that the sterilised soils, during the first few days, clearly exhibit a low capacity of water absorption, which proves that the sterilisation of the soil by means of steam produces not only biological but also physico-chemical changes. In order to obviate this drawback it is advised that the soil should be watered with distilled water to the optimum point of humidity for 6 or 7 days ; if this precaution is taken the young plants suffer less. Passing on now to the general considerations emerging from the figures in the table, it is seen that the sterilisation of the tchernoziom brings with it a considerable increase in the production of the total vegetable mass, and that the effect of sterilisation, disregarding slight fluctuations one way or the other, is the same as that produced by complete mineral manuring.

As regards the chloroforming, it also brought about an increase in the total vegetable mass produced ; its effect nevertheless was less considerable as compared with sterilisation and complete mineral manuring. What

*Fertility of Tchernoziom non-manured, manured, sterilised and chloroformed.*

| Manures applied and mode of treatment of the samples of tchernoziom | Average weight in gr. of the total vegetable mass (seed and straw) | | | | Ratio between the vegetable masses, that of the control series being taken as the unit | | | |
|---|---|---|---|---|---|---|---|---|
| | on april fallow (layer from o to 17.7 cm) | on april fallow (layer from 17,7 to 35.5 cm) | on cleared land (layer from o to 17.7 cm) | on 3 years lucerne soil (layer from o to 17.7 cm) | on april fallow (layer from o to 17.7 cm) | on april fallow (layer from 17,7 to 35.7 cm) | on cleared land (layer from o to 17.7 cm) | on 3 years lucerne soil (layer from o to 17.7 cm) |
| 1. Unmanured. . . . . | 12.27 | 6.48 | 7.59 | 12.21 | 1.00 | 1.00 | 1.00 | 1.00 |
| 2. Nitrogenous manuring . | 13.14 | 5.51 | 7.07 | — | 1.06 | 0.85 | 0.93 | — |
| 3. Phosphate » . | 18.45 | 16.41 | 10.09 | — | 1.49 | 2.53 | 1.32 | — |
| 4. Complete mineral » . | 33.64 | 33.60 | 27.09 | 28.45 | 2.74 | 5.18 | 3.56 | 2.33 |
| 5. Sterilisation . . . . . | 36.21 | 31.55 | 30.69 | 27.69 | 2.95 | 4.86 | 4.04 | 2.26 |
| 6. Chloroforming . . . . . | 21.08 | 22.39 | — | — | 1.71 | 3.45 | — | — |

are the causes of this increase in fertility? In order to reply to this question the writer carried out researches on the bacterial flora of the soils under study and determined the chemical composition of the sterilised samples, paying special account to two elements: phosphorus and nitrogen. Two cultures were made, one on agar, the other on gelatine; for each, peptonised beef bouillon, diluted to 0.001 in the one case and in the other to 0.0001, was utilised as the nutrient liquid. The calculation of the number of bacteria was made in Petri dishes in reference to one gram of absolutely dry soil. These experiments were only made with April fallow tchernoziom

The results of these calculations, compiled in several tables, prove that the bacterial flora of chloroformed and sterilised tchernoziom is incomparably more numerous than the normal; that it is more numerous in the arable soil than in the layer below, and that in the case of sterilisation, it is more numerous on agar than on gelatine. For instance, for the normal samples of the arable layer in the culture on agar, with a dilution to 0.001, the number of bacteria before the experiments was 160 000 per one gram of absolutely dry soil; after the experiments, 167 000, or an insignificant increase. In the soil chloroformed after the experiments the number of bacteria was 3 152 000 and in that sterilised it was 2 138 000. Considering the case of the chloroforming of the tchernoziom, and laying stress on the fact that it creates conditions in the soil which lead to a more energetic multiplication of the bacteria, the writer believes that this action of the chloroform must be the principal cause which, in chloroformed soils, leads to the increased production of vegetable mass, because with the more intense development of the bacterial flora those processes which enrich the soil in fertilising elements, especially nitrogen and phosphorus, also intervene with greater intensity. The enrichment of the soil in this latter element phosphorus, takes place, according to the writer, at the expense of its organic

forms which are decomposed under the action of a highly numerous bacterial flora and give rise to the transformation of phosphorus from the non-assimilable state into the assimilable state. On the other hand, the insoluble mineral phosphates pass into the soluble state, as was proved by STOKLASA, under the action of the carbonic, formic, butyric and acetic acids produced by the organic substances formed by the multiplication of the bacteria. With regard to the nitrogen, the increase in this element must be attributed to the fixation of atmospheric nitrogen by the bacteria, and to the organic substances of the soil.

Passing on to sterilisation, it is useful to note that the bacteria flora of sterilised tchernoziom exhibits one peculiar feature, namely, it develops much less readily on gelatine than on agar ; according to the analysis made by the writer, it is constituted by the microbes of the air, and therefore it cannot play an important part in the increase of the fertility of the soil. In order to study the cause of this increase the writer examined the quantity of phosphoric acid soluble in 2 % acetic acid contained in the sterilised and the non-sterilised soils, and he found that the sterilisation results in a substantial increase of soluble phosphoric acid ; in the arable strata the increase varies between 87.87 and 120.67% and and in the strata lying beneath the arable layer, from 47.05 to 76.54%. Among the sources contributing to the increase of phosphoric acid, the writer allots the first place to the nucleins, which contain 5.7 % of phosphorus and which, at the temperature of 150° C., decompose with liberation of phosphoric acid. The question of the nitrogen is not so clear as that of the phosphorus, because an equal quantity of it was observed both in the sterilised and in the unsterilised soils. It not being possible, however, to attribute an increase of fertility in the sterilised soils exclusively to the increase in soluble phosphoric acid, and taking into account at the same time the fact that by the sterilisation all the microbes were killed, and therefore it is not possible to assume the existence in the soil of the microbiological processes which result in the accumulation of assimilable nitrogen, the Author assumes here the influence of the decomposition of organic substances through the action of sterilisation.

The increase in the quantity of assimilable nitrogen in the sterilised soils was borne out by the fact that the plants, during the entire period of growth, were of a beautiful green colour even more intense than that of the sample which received complete mineral manuring.

The concrete outcome of the experiments is the following :

1) Researches into growth carried out on chloroformed samples of tchernoziom and supplemented by bacteriological and chemical investigations prove that the accumulation of the fertilising substances in the tchernoziom, which depends on the degree of vital intensity of the soil bacteria, does not, even under the best conditions of soil cultivation, supervene with the same intensity with which it might take place under other more favourable conditions.

2) Researches into growth, carried out in sterilised samples of the tchernoziom supplemented by bacteriological and chemical investigations,

render it clearly evident that tchernoziom is sufficiently rich in crude elements, both in the form of vegetable and animal residues and in other forms with which, under conditions favourable to the process of disintegration and synthesis brought about by bacteria, a remarkable storage of the fertilisable substances assimilable by plants may be created.

961 - **Study of the Nitrification of Different Leathers available for Agricultural Use, and Sulphurated Rape Cakes.** — GUILLIN (Director of the Laboratory of the Society of Agriculturists of France), in *Comptes Rendus de l'Académie d'Agriculture de France*, Vol. II, Year 1916, No. 27, pp. 760-769. Paris, 1916.

MANURES AND MANURING

Crude tanned leather has long been regarded as a product which only decomposes slowly in the soil. During the last few years another kind of leather, chrome leather, has appeared on the manure market. This leather, owing to its almost white colour (pale green), is rarely sold under the name of leather, but is marketed in the form of shavings. This chrome leather, of non-putrescent substance, may *a priori* be regarded as not subject to rapid decomposition. Experiments were undertaken with the object of ascertaining whether this view was correct.

The attempt has been made to render the leathers more easily decomposable in the soil by various processes. The most usual of these processes is roasting ; roasted leathers are in almost all cases rendered slightly acid by the addition of a small quantity of sulphuric acid, but this quantity is altogether insufficient to render their decomposition in the soil easier. Besides this, some manufacturers have sought to transform leather completely by dissolving it in sulphuric acid, afterwards saturating the excess of acid so as to obtain a manure in powder form put on the market under different names: azotine, nitrogene, etc. Two of these dissolved leathers were studied by the writer: for one, sulphuric acid was used in such a quantity as to convert the leather waste into a pasty mass. For the other, the quantity of acid used was greater and the mass was liquefied. The study related, in brief, to the comparative nitrification of tanned leather, chrome leather, roasted leather and leather dissolved in sulphuric acid in a paste and in liquid form, as well as the nitrification of sulphurated rape cake. Dried blood was taken as a standard of comparison.

*Composition of the Manures studied.* — The composition of the manures studied is shown by the following table :

| | Total nitrogen | Soluble organic nitrogen | Ammoniacal nitrogen |
|---|---|---|---|
| | — | — | — |
| Dried blood | 11.72 % | 0.63 % | 0.26 % |
| Tanned leather | 8.15 | 0.25 | nil |
| Chrome leather | 8.87 | 0.11 | nil |
| Roasted leather | 6.77 | 0.17 | nil |
| Dissolved leather (paste) | 6.63 | 2.33 | 0.25 |
| Dissolved leather (liquid) | 7.36 | 2.81 | 1.18 |
| Sulphurated rape cake | 5.62 | 0.61 | nil |

*Mode of Procedure.* — The nitrification experiments were carried out with clayey-lime soil of the basin of Paris (Gournay, Seine-et-Oise); this

earth, which contained 0.115 gr. of nitric acid per kg., was rendered thoroughly homogeneous, then brought up to a moisture percentage of about 20 %, after which lots of one kilogram were taken from it. The different manures having been reduced to an exceedingly fine powder, a weight of each of them corresponding to 1 gr. of nitrogen was weighed off; each of these weighed quantities was thoroughly mixed with 1 kg. of earth. For each manure, three different preparations were made, in order to be able to ascertain the quantity of nitric acid formed, after different periods of experimentation. The nitric acid contained in the mixture of soil and manure was also determined after 1,2 and 5 months' contact. By way of control the same was done with 3 lots of one kg. of earth to which no manure had been added, and the following results were reached :

*Nitric acid contained in one kilogram of earth.*

| | After 1 month | Two months | Five months |
|---|---|---|---|
| Soil without manure | 0.145 gr. | 0.160 gr. | 0.326 gr. |
| Dried blood | 1.080 | 1.350 | 2.433 |
| Tanned leather | 0.166 | 0.190 | 0.404 |
| Chrome leather | 0.003 | 0.021 | 0.227 |
| Roasted leather | 0.220 | 0.265 | 0.523 |
| Dissolved leather (pasty) | 0.742 | 0.952 | 1.547 |
| Dissolved leather (liquid) | 0.990 | 1.200 | 2.015 |
| Sulphurated rape cake | 0.888 | 1.287 | 2.291 |

One of the results appeared to be altogether abnormal, namely that given by the mixture of 1 kg. of earth with about 11 gr. of chrome leather; not only was there no nitrification, but, a far more surprising fact, the pre-existing nitrate disappeared. This rapid distruction of the nitrates was so complete as to surprise the writer, who wondered whether the loss of the nitric acid during the course of its determination, was owing to the presence of chrome in the exhausting liquid. He therefore deemed it desirable at the same time to carry out a chemical control of his method of estimation and also an agricultural control.

*Chemical Control.* — In order to ascertain the proportion of nitric acid the procedure adopted was as follows : when the mixtures of earth and manure had been undergoing nitrification for the required time, they were placed in a 2-litre flask, 500 cc. of water added and the flask rotated on the SCHLOESING car. After a quarter of an hour the earth and water were completely mixed, and the nitrates were dissolved in the surface liquid ; the liquid was drawn off into a large glass, the soil was allowed to settle and the surplus liquid filtered. 250 cc. of water were poured into the earth, which was shaken up and filtered after settling. This washing by decanting was once more repeated, after which the liquid and the mud were conveyed into the filter, and the latter washed after completion of draining off. In this way there were obtained the nitrates contained in the soil in a clear but very but dilute solution, which it is necessary to concentrate in order to determine the quantity by the SCHLOESING method.

The nitrate must have been lost in the course of this concentration and determination.

For the purpose of checking this loss, if any, the writer, with a soil different from that previously used, made two mixtures with one kilogram of earth with chrome leather under the conditions described. These two mixtures were kept for forty days in two vessels ; at the same time, and under the same external conditions, a kilogram of earth was studied by way of control. After 40 days, when the three lots were exhausted on the method used in the preceding experiments, the two liquids resulting from the exhaustion of the mixture of earth and chrome leather were combined, mixed and divided into two equal volumes. In one, after concentration, the percentage was measured direct ; to the other there was added a quantity of nitrate containing 0.150 gr. of nitric acid, it was then condensed and the contents measured. The results arrived at were as follows :

*Nitric Acid per Kilogram of Earth.*

| | |
|---|---|
| Existing in the soil at the start of the experiment . . . . . | 0.093 gr. |
| Contained in the soil forty days later . . . . . | 0.110 |
| Contained in the mixture of soil and chrome leather . . . . | 0.003 |
| Found after the addition of 0.150 of nitric acid to the exhausting liquid . . . . . | 0.155 |

The method of measuring the contents of nitric acid therefore plays no part in the results found.

*Agricultural Control.* — 3 pots of equal size were used, each capable of containing about 15 kg. of earth; into one, earth was put without manure, into the second, earth mixed with chrome leather, and into the third earth mixed with dissolved leather. In each pot 25 grains of wheat were sown on the 16th April. These germinated normally on the 21st April. In the early days of May the young wheat stalks differed clearly ; the plants growing in the pot containing earth mixed with chrome leather were of very poor vitality, the leaves being yellowish in colour, while the plants in the other pots were strong, and the leaves were a fine dark green, particularly in the pot containing earth mixed with dissolved leather. The plants were weighed on the 1st July. Taking the weight of the crop in the vessel to which no leather was added as 100, the weight of the three crops will be represented by the following figures :

| | |
|---|---|
| Earth without manure . . . . . | 100 |
| Earth with chrome leather . . . . . | 30 |
| Earth with dissolved leather. . . . . | 115 |

*Interpretation of the Results and Conclusions.* — Chrome leather is injurious to vegetation, and should therefore not be be regarded as a manure. The chromium sesquioxide contained in this leather becomes hyperoxidised in the soil, destroying the nitrates, and after five months' contact the decomposition of the leather is so small that the earth with which it has been incorporated contains less nitrate than earth to which no manure has been added.

Farmers should not use tanned leather, which is of no fertilising value, nor roasted leather, the farm value of which is much below the commercial value. These manures, even under the conditions of the experiment, which were exceedingly favourable to nitrification, only gave the following quantities of nitric acid per gr. of nitrogen contained:

| | In one month | Two months | Five months |
|---|---|---|---|
| Ground tanned leather . . . . . | 0.021 gr. | 0.030 gr. | 0.078 gr. |
| Ground roasted leather . . . . . | 0.075 | 0.105 | 0.197 |

On the other hand, leathers dissolved in sulphuric acid showed a considerable nitrification, and they may be used to advantage by farmers; but even here, in order to obtain the maximum effect with these products, the treatment with sulphuric acid must be very active, and must not leave behind any non-disintegrated fragments of leather.

962 - **Catalytic Manures: Manganese as a Catalyser of the Biochemical Reactions by means of which Plants Assimilate Atmospheric Nitrogen through Bacterial Agency.** — De Gregorio Rocasolano Antonio, in *Revista de la Real Academia de Ciencias exactas, físicas y naturales de Madrid*, Vol. XIV, No. 10, pp. 681-693, 3 diagrams. Madrid, April 1916.

Experiments carried out starting from the hypothesis that any cause capable of exciting the biochemical activity of the nitrogen-fixing organisms contained in the soil will have the effect of increasing the quantity of atmospheric nitrogen fixed in the soil or in the plant, and consequently of increasing the crop. There were used for these experiments pure cultures of *Bacillus radicicola* isolated from the root nodules of red clover cultures of *Clostridium Pasteurianum* and *Azotobacter chroococcum* isolated from a cultivated soil.

Quantities of 100 cc. of culture bouillon (to which mannite had been added and which contained a known percentage of nitrogen) were placed in Erlenmeyer flasks, and inoculated with pure cultures of *B. radicicola*. One flask was used as control. To the 7 others increasing amounts of a graded solution of manganese chloride were added. The flasks were incubated for 25 days at a temperature of 22-23° C. and afterwards sterilised. Finally the total quantity of nitrogen in the contents was determined by the Kjeldahl method. The experiment was repeated in several series. The results show that *B. radicicola* fixes atmospheric nitrogen even in the absence of manganese, but the manganese modifies the rapidity of reaction, that is to say it is a catalyser of the biochemical reaction; it accelerates the latter in increasing proportions up to the optimum quantity which is 0.006 gr. of manganese ion per 100 cc. of bouillon. With this amount the quantity of nitrogen fixed was about three times that of the control. With doses of manganese in excess of the optimum, the acceleration falls off suddenly, then (at 0.020 gr. %) the action changes into one of retardation. The experiments with *Clostridium Pasteurianum* were conducted in the same way as those described above. The manganese is of great importance to this micro-organism, as it was found that in the absence of this element it

does not fix atmospheric nitrogen. In its presence it fixes nitrogen in appreciable quantities. The optimum degree of concentration of the catalyser is the same as for *B. radicicola* (0.0041 gr. of nitrogen per 100 cc. of culture bouillon were fixed with this amount); in concentrations higher than the optimum, the acceleration is diminished and finally becomes negative.

The experiments with *Azotobacter chroococcum* yielded results similar to the preceding ones. This bacterium likewise only fixes atmospheric nitrogen in the presence of manganese; the optimum concentration of the manganese ion is about the same.

The practical conclusion is that fertilisers containing manganese increase the crop, if applied in quantities furnishing up to 0.006 gr. of manganese ion per 100 gr. of soil. They reduce it if administered in quantities in excess of this. The majority of soil contain quantities of manganese in excess of the above optimum, but the bulk of this manganese is in insoluble form. In order to calculate the quantity of manganese salt to be put down as manure, therefore, it is first necessary to ascertain the quantity of soluble manganese contained in the soil and add only the difference.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS.

963 - **Successful Treatment with Insecticides of Plants in Flower.** — SHREIBER A. F., in *Трудыі Бюро по прикладной Ботаникѣ* (*Bulletin of Applied Botany*), IXth Year, No. 4 (89), pp. 174-175. Petrograd, April 1916.

After referring to the experiments by Prof. S. GLASENAP, on the successful treatment with tobacco juice of apple trees in flower (1), the writer gives the results of his own experiments at Irkutsk (Siberia) on an experimental field for the cultivation of medicinal plants.

The experiments were carried out on *Calendula officinalis* L. which is very liable to the attack of the larvae of *Mamestra brassicae*, these latter devouring the leaves. One part of the plants in the field was sprayed with dilute extract of aloes and the other part with a solution of extract of *Veratrum album*. Two successive sprayings were made which killed off all the larvae. This treatment did not reduce the crop of seeds, and the plants watered in this way when in flower all yielded ripe seeds.

964 - **Osmotic Pressure of Soil Moisture and Glassiness of the Grain of "Bielotourka" Wheat.** (From the Works of the Laboratory and Growing Shed of the Scientific Agricultural Station of Bezentchouk, Province of Samara, Russia). — TOULAIKOV N., in *Журналъ Опытной Агрономіи* (*Review of Experimental Agriculture*), Vol. XVII, Book I, pp. 79-91. Petrograd, 1916.

Great fluctuations in the price of hard wheat, which took place on one and the same day at the Exchange of Samara, attracted the attention of the Station, which, from 1913 onwards, organised a series of experiments on the glassiness of the grain of the "Bielotourka" hard wheat, thus continuing work on the relations between the osmotic pressure of the soil moisture and the growth of the wheat in question (2).

(1) See *Bulletin de Botanique appliquée*, Vol. VI, No. 4, pp. 243-247; Petrograd, 1915. (*Ed.*)

(2) See *B.* 1914, No. 980. (*Ed.*)

In 1913 it was noticed for the first time in the laboratory that in " Bielotourka " wheat cropped from the same pot some grains were found with glassy fracture and others with floury fracture, and that the number of floury grains was greater in the pots with greatest soil humidity.

In 1914 and 1915 experiments were carried out in order to study the distribution of the floury grains in the ear, as it was at first assumed that the presence of these grains in the wheat ear of " Bielotourka " was a defect which must have occurred in the grains of the upper part of the ear, the said grains being incompletely ripe or developing under abnormal conditions. The result of the experiments carried out with great care was however negative, that is to say, it was not possible to detect any relation between the location of the grain on the ear and the character of its fracture.

In 1915 experiments with pure lines of " Bielotourka " were made, the humidity of the soil in the pots being maintained at 50, 60, 70, 80 and 90 % of complete saturation, or approximately at 20, 24, 28, 32 and 36 % of its weight when completely dry. The experiments demonstrated that while with 20 % of moisture in the soil all grains have a glassy fracture, with an increase above this percentage the grains with more or less clear floury fracture appear, and in the pot with 35 % of moisture in the soil the grains with glassy fracture form only 10.8 % of the total crop. Thus the glassiness or floury fracture of the grain of "Bielotourka " wheat, even within the limits of a pure line, does not represent a constant character, but the fracture may be modified under the influence of external factors intervening in the course of growth, and, in the particular case under study, under the influence of the degree of moisture of the soil.

In order to investigate the influence of osmotic pressure on the character of the " Bielotourka " grain, experiments were made in the greenhouses; effect of changes in the osmotic pressure were studied by adding to the soil the necessary quantity of the following salts: chloride, sulphate and nitrate of sodium, ammonium sulphate, ammonium nitrate. The appended table brings out clearly the relation between the osmotic pressure (determined in this particular case by the addition of sulphate of soda), and the nature of the grain of " Bielotourka ".

Evidently therefore the quantity of grains with glassy fracture increases with the rise of the osmotic pressure in the soil moisture, and at the pressure of 7 atmospheres all grains had become glassy.

It follows from a comparison of the data relating to the other salts experimented on, that their action is not equal ; nevertheless, by gradually increasing the osmotic pressure of the soil solution a greater quantity of glassy grains is obtained, and at a given pressure for each salt, all the grains become glassy. Thus by modifying the pressure of the salt salution it is possible to obtain glassy or floury grains at will with " Bielotourka " wheat. The following fact was also clearly brought out: sodium salts exert a different action of the formation of the glassy grain, according to their acid radicles. Sulphate of sodium exerts the feeblest action ; chlorine acts more and nitrate of soda still more strongly ; with the addition of this last salt in a sufficient quantity to raise the osmotic pressure to 2 atmospheres, almost

*Osmotic Pressure of the Soil Solution and Character of the Grain of "Bielotourka" Wheat.*

| Osmotic pressure in atmospheres | Percentage of total crop exhibiting a: | | |
|---|---|---|---|
| | floury fracture | glassy-floury fracture | glassy fracture |
| 0.5 | 27.8 | 70.0 | 2.2 |
| 1.0 | 8.3 | 88.5 | 3.2 |
| 1.5 | 3.6 | 83.0 | 13.4 |
| 2.0 | 3.3 | 76.8 | 19.9 |
| 3.0 | 2.2 | 65.6 | 32.2 |
| 5.0 | 1.7 | 48.0 | 50.3 |
| 7.0 | nil | nil | 100.0 |

the whole of the grain becomes glassy, while with sodium chloride and sodium sulphate at the same osmotic pressure only 20 % of glassy grains are produced.

The presence of nitrogen in the basic or acid radicle of a salt reacts on the quantity of glassy grains in the crop : for all ammoniacal salts, as likewise for sodium nitrate, even at low osmotic pressures (1.5-2.0) the whole of the grain is glassy. Thus, between glassiness of the grain and the presence in the soil of a quantity of nitrogen in excess of that found there, normally a very clear connection exists, *viz* : the increase of nitrogen in the nutrient medium entails an increase in the quantity of grain with glassy fracture.

With a view to better studying the glassiness of the grain, the Station in 1913 made an analysis of this grain as to its total nitrogen content ; the "Bielotourka" grain was taken from a single pot in which the humidity of the soil had been maintained at 24 % of its total weight in the absolutely dry state ; this grain was divided into three groups according to the character of the fracture.

The following results were obtained : the glassy grain represented about 20 % of the total quantity, and contained 2.02 % of nitrogen ; the glassy-floury grain formed 38.3 % and contained 1.80 % of nitrogen, and finally the floury grain formed 41.7 % and contained 1,62 % of nitrogen ; it follows that the glassy grain contains a larger quantity of nitrogen than the floury grain. Similar investigations were made into the soft wheat grain "Poltavka", produced under conditions identical with those of "Bielotourka" the glassy grain of the soft wheat contained 2.08 % of nitrogen and the floury 1.83 %.

The quantity of nitrogen in the glassy grain increases with the increase of the osmotic pressure of the soil moisture determined both by nutrient and non-nutrient salts, and with the increase in the percentage of glassy

grains. Equal percentages of nitrogen content correspond to equal percentages of glassy grains. Thus, according to the experiments in 1915, with sodium sulphate, sodium nitrate and ammonium nitrate, for the first two salts, at 32-38 % of glassiness of the grains, the content of nitrogen is nearly the same, fluctuating about the figure of 2 % (2.40-1.969 %). When the glassiness reached 100 %, an almost uniform percentage of nitrogen is obtained with all the salts, near 2.8 % (2.711-2.907 %).

The fact emphasised by the Author in his diagrams should be noted, that in the grain, even when the whole of it has become vitreous, the content of nitrogen continues to grow with the increase of the osmotic pressure according to the rule formulated herewith.

It is therefore concluded that the glassiness of the grain is not the factor on which the total content of nitrogen of the wheat grain depends, but that this latter property, as likewise the glassiness, depends, under certain external conditions of growth, on a more general cause, namely the osmotic pressure of the soil moisture and the quantity of soluble nitrogen contained in the soil. For instance, it may be assumed that the increase in the osmotic pressure causing a rise in the nitrogen contained in the grain of " Bielotourka " wheat, also produces an increased degree of glassiness of the grain. The influence of the degree of moisture of the soil may be explained by the fact that a greater humidity of the soil means a weaker concentration of the solutions and a lower osmotic pressure of the soil solution.

965 – **Senile Changes in the Leaves of *Vitis vulpina* L., and certain other Plants.** — BENEDICT HARRIS M., in *Cornell University, Agricultural Experiment Station of the College of Agriculture*, Memorandum No. 7, pp. 275-370, tables 59 + 52-58 fig. Ithaca, New York, June 1915.

An examination of the observations of modifications resulting from senility in perennial plants indicates that in this direction no investigations have been carried out on the lines of those undertaken in the animal kingdom. Observations on the effects of age in plants represent occasional records rather than investigations. The reason of this appears to be the tacitly accepted belief that since new leaves, stalks and roots are constantly formed from persistent embryonic cells, senility, as it occurs in animals, must not be considered in relation to plants, and that this term, when used of plants, merely means that the conditions have become so unfavourable that parts in process of growth are killed. This view was encouraged by the very advanced age attained by some trees. The importance, however, of determining whether or not senile modifications occur in plants, lies not only in the scientific interest of this determination but also in its reaction on the vexed question relating to the effects of the continuous vegetative propagation of seed-producing plants.

For his investigations the writer adopted *Vitis vulpina* L., a plant remarkable for the extreme vigour with which it puts forth a new growth every year, in order to reduce to the lowest possible minimum the likelihood of unfavourable conditions other than old age. He therefore carefully sought out, in the vicinity of Ithaca, New York, and Cincinnati, Ohio, vines of different ages growing near to each other under the most similar possible ex-

ternal conditions. He was able to find 20 pairs of vines answering to these conditions, each pair consisting of a young and old vine. From each vine he took 10 healthy, normal leaves which had reached full development, and he examined the venation of these leaves. In this examination he took into account the following principles previously established either by other observers or himself: the islets, bounded by ribs, are of a constant size in the different parts of the leaf; they are of the same size in leaves of different size or thickness taken from one and the same plant; furthermore, in leaves of one and the same vine having a different solar exposure, the exposure has no influence on the surface of the islets.

In vines of different ages, however, the surface of the islets varies greatly, being much larger in the youngest vines: the variation ranges from 0.5154 sq. mm. in a 3 year old vine to 0.1376 sq. mm. in a 70 year old vine. This difference cannot be attributed to anything but old age, the effect of which is to give rise to a denser growth of the vein system, with a reduction of the islets bounded by the ribs. From this a method is deduced for determining the age of *Vitis vulpina* by mere examination of the venation and the following table is given for that purpose:

| No of veinlets intersecting a 2 cm. line | Corresponding Age of the Vine |
|---|---|
| 30 to 35 | 5 years or less |
| 35 to 45 | 5 to 15 years |
| 45 to 50 | 15 to 35 years |
| 50 to 75 | 35 years and more |

He verified the conclusions to which he had been led from examination of the leaves of *V. vulpina* by checking with other plants: *Vitis bicolor*, Le Conte, *Tecoma radicans* L., *Salix nigra* March, *Castanea dentata* Bork, *Quercus alba* L., *Tilia americana* L., *Ulmus americana* L., *Carya alba* Koch, *Carya ovata* Koch, *Acer saccharinum* L., *Acer saccharum* Marsh, *Quercus velutina* Lam., *Platanus occidentalis* L., and *Fraxinus americana* L. These plants all allowed of the same observations as to the influence of age with regard to the venation.

If age affects the meristematic tissues of seed-producing plants, the cells of the scions used for propagating certain varieties must be equally affected. The writer having considered this hypothesis verified it by his observations: plants produced by grafting are, as regards the leaves, of the age of the plant which furnished the scion, this age being reckoned from the time of production of the parent plant from seed; grafting and growth on the host do not renovate the youth of the tissues of the scion.

These conclusions are next discussed, and the causes to which the senility of leaves is to be attributed are sought for. The insufficiency of conveyance of nutrient liquids by the vessels of plants which have grown old is dismissed. The possibility of the production of toxins is an attractive hypothesis, but there is no direct and evident proof of their existence, and this hypothesis must be abandoned, because senility persists in cuttings separated from the old plant. It is therefore suggested that the visible

variation in the network of veins on the leaves is a progressive modification in the cells of the meristem and the leaf inherent in the nature of their protoplasm, this progressive variation being called senility in regard to animal protoplasm ; the increase of the vascular tissue of the leaf with age furthermore constitutes a degeneration as regards physiological activity.

In order to establish this latter point the writer compared the photosynthetic activity of leaves belonging to old or young trees respectively. He made use of a method of approximation consisting in determining the gain of weight in one day of fragments of leaf equally exposed to sunlight. The determinations, carried out in August, gave the following general results as regards *Vitis vulpina :*

| | |
|---|---|
| Average gain for leaves of 5 to 8 year old vines . . . . . | 9.4 % by weight |
| Average gain for leaves of 20 to 25 year old vines . . . . . | 1.4 % " " |

He likewise determined the rate of elimination of carbonic acid in leaves taken from *Vitis vulpina* at different ages, and obtained the total results exhibited by the following table:

| | |
|---|---|
| Average age of the young vines utilised . . . . . | 7.3 years |
| Average age of the old vines utilised . . . . . | 25.4 years |
| Number of determinations made . . . . . | 92 |
| Average duration of each determination . . . . . | 23.86 hours |
| Rate of elimination of carbonic acid for the young vines . | 0.0349 % per hour |
| Rate of elimination of carbonic acid for the old vines . | 0.0297 % per hour |

He next started to determine the quantity of water absorbed by young and old vine leaves, reduced to fine powder, in order to have indications as to the capacity of living leaves to retain water. He observed first of all that acidity is higher in the powder of young leaves than in that of old leaves (in the former case an average of 2.2 cc. of a decinormal solution of potash is required to neutralise 0.2 g. of powder, against 1.5 cc. for old leaves) ; in order to get rid of the influence of this acidity, he neutralised the substances subjected to experiment and obtained the following results :

| | |
|---|---|
| General average of water absorbed by the leaves of young vines . . . . | 489.0 % |
| General average of water absorbed by the leaves of old vines . . . . . | 387.9 % |

Finally, he looked for and found other signs of senility. Thus he observed the variations in the number of stomata in *Vitis vulpina* of different ages.

*Number of stomata in* 1 *sq. mm., average for vines of* :

| | |
|---|---|
| 5 to 7 years . . . . . | 117 |
| 8 to 10 years . . . . . | 129 |
| 20 to 30 years . . . . . | 282 |

He next proposed to determine the size of these stomata, and reached the following results :

*Average longitudinal diameter of the stomata.*

| | |
|---|---|
| Vines from 5 to 7 years . . . . . | 16.6 μ |
| Vine from 20 to 30 years . . . . . | 10.8 μ |

Similar results were also obtained by the measurement of the cells of the palisade layer in the leaves (12.2 μ in the 5 year old vines as against 10.3 μ in those of 20 year old vines) and by determining the ratio between the cytoplasm and the nucleus (this ratio being 388 to 1 in the vines aged from 5 to 7 years, as against 478 to 1 in those of 20 to 30 years) ; nevertheless this latter determination does not present all the necessary conditions of accuracy.

The writer next draws conclusions from these observations, and in particular envisages their application to the question of the degeneration of plants reproduced by scions or slips ; he lays stress on the interest attaching to investigations on this important question. Finally he examines and generalises the theories of senility, in order to extend them both to the animal and vegetable kingdom. He rejects the theories relating to the localisation of senile modifications, including the theory of METCHNIKOFF on the part played by toxins secreted in the main intestine of animals and in the flower of plants. He likewise does not admit that old age is due to the accumulation of katabolic products, or to the decreasing elimination from the body of the products of secretion of cells placed far away from the surface. To him, old age results from a physical or chemical degeneration involving the protoplasm itself, producing among other changes a diminution of permeability, and he concludes that the evidence appears very strong, both from the point of view of senility and that of regeneration, that the duration of life is directly bound up with the degree of permeability found in that part of the living cell which is in contact with the surrounding universe, and that in proportion as the activities of life continue, the cell is entombed by an inexorable diminution in the permeability of its protoplasm. The fundamental cause of this diminution may very well be the colloidal nature of protoplasm. The relatively simple relations existing in non-living complex colloidal bodies tend to be modified under the action of external forces, or even by the mere action of time ; it seems inevitable that the extremely complex colloidal states which form protoplasm should be modified progressively by the activities of life and by the intervention of external forces. What should give rise to astonishment is not the senile modifications of the protoplasm, but their tardiness in appearing.

Regeneration is the process by which the original arrangement of the colloidal elements constituting the protoplasmic colloids is restored.

Sexual reproduction is one of the methods by which this regeneration is accomplished, while it is ensured by more primitive methods in asexual plants.

It is for the future to solve the question whether the progress of senility in sexed plants and animals can be arrested or even retarded by means of regeneration such as are utilised in asexual forms, and which are thus to a certain extent applicable to the whole of the somatic cells. The know-

ledge which we at present possess as to the cause of senile degeneration does not allow of a rash negation of the possibility of somatic regeneration.

In a bibliographical appendix the writer gives a list of 57 works.

PLANT BREEDING

966 - **Experiments in Siberia, on Different Varieties of Oats.** — (Communicated by the Establishment for Seed Production of Smoline L. D. and Skalosoubov N. L., situated near Kurgan, Government of Tobolsk, Siberia). — SKALOSOUBOV N. L., in *Сельское Хозяйство и Лѣсоводство* (*Agriculture and Sylviculture*), Year LXXVI, Vol. CCL, pp. 562-571. Petrograd, April 1916.

The experiments begun in 1913, chiefly with the object of elaborating and establishing the methods and technique of selection, were resumed in 1914, the original selected seeds being made use of wherever possible. The following varieties were experimented on: 1) " Rykhlik " oats of the Experimental Station of Sobiechine, coming from Siedlez,Poland (No. 809); 2) " Golden rain " from Svalof (No. 766); 3) Imchinsk oats, received from Tobolsk (No. 743); this variety was held in good repute 15 years ago; 4) beardless Probstei oats from Svalöf (No. 747); 5) " Victory " from Svalöf (No. 768); 6) " Ligovo II " from Svalöf (No. 768); 7) " Rykhlik " from Sobiechine, first growth of this variety on the farm (No. 553).

On the basis of the description of the varieties of oats given by KORNICKE, the writer states that among the 6 varieties experimented on, 4 were found to be homogeneous from the botanical point of view: the " Golden rain " may be referred to *Avena sativa patula* var. *aurea*, Keke; the Probstei beardless to the same variety; " Ligovo II " to the variety *A. sativa patula aristata* Keke; " Victory " to the variety *A. sativa patula* var. *praegravis* Kr.; the " Rykhlik " from Sobiechine appears to be a mixture of the three forms of *Avena sativa: patula* var. *trisperma* Schübler, *aristata* Kr., *praegravis* Kr., or of four forms, namely the 3 preceding ones and in addition the variety *aurea* Keke; finally the Imchinsk oats are made up of three forms: *A. sativa patula: mutica* Al., *praegravis* Kr. and *aristata* Kr.

The experiments were made on plots of 109.25 sq. metres (0.01 dessiatine), each being repeated on 3 plots, taking as the standard of comparison the original " Rykhlik " variety from Sobiechine (No. 909). The oats followed potatoes on a sandy tchernoziom soil ploughed in autumn and spring before sowing.

In estimating the results the writer did not confine himself to the arithmetical mean of the crops, but also made allowance for the probable error; he also carried out researches into the more or less close stand of the culms, on tillering, earliness, on the variations in the weight of the glumes, and on the absolute weight of the grain. He thus found that from the point of view of yield the varieties " Rykhlik " from Sobiechine and the 3 Svalöf varieties, namely " Victory ", " Probstei " and " Golden rain ", stand out; from the point of view of earliness: the " Rykhlik " from Sobiechine and " Golden rain "; as regards weight of glumes " Probstei ", " Golden rain " and " Rykhlik " from Sobiechine are the most prominent, and as regards the absolute weight of the grain: " Rykhlik " from Sobiechine, " Victory " and " Probstei ", while " Golden rain " ranks last in respect of this

character, which renders it highly valuable for sowing because in order to sow a given surface a smaller quantity of small than of large grains will be needed.

The direction of variability of the varieties tested under the local conditions of Siberia is clearly brought into evidence by the table annexed, in which a comparison is made between the two characters : grain production and size of the seeds (the data for the Svalöf varieties are taken from the publications of the Svalöf Company).

This table shows that under the conditions ruling in 1914, which was a favourable year, all the Svalöf varieties with the exception of " Ligovo II " gave a better unit production in Siberia than in their country of origin, i. e. Southern Sweden. As regards the absolute weight of the grains, it diminished in the varieties " Golden rain " and " Probstei ", while it increased in " Victory " and " Ligovo II " ; but if account is taken of the fact that the Svalöf seeds were put on the market after very careful sorting out for size, while for the seeds grown in Siberia the sorting was reduced to getting rid of the stunted and light seeds by the Clayton and Reber apparatus, this difference becomes quite unimportant. The comparison between the numbers of grains contained in 21.33 gr. of the original product and in that obtained in Siberia renders the reduction in size of the Siberian-grown grains more strongly evident ; this is explained by the fact that the Siberian grown grains were not sorted out with regard to weight and that the Svalöf seeds employed for sowing were, in respect of absolute weight, slightly above the averages published by the Svalof Station.

*Variability of the Varieties of Oats when grown in Siberia*

| Varieties of Oats | Original productivity | | | Productivity in Siberia | | |
|---|---|---|---|---|---|---|
| | Productivity per acre in cwt. | Absolute weight of 1 000 grains of oats gr. | Number of grains of oats in 21.33 gr. | Productivity per acre in cwt. | Absolute weight of 1 000 grains of oats gr. | Number of grains of oats in 21.33 gr. |
| « Rykhlik » from Sobiechine | — | — | 550 | — | — | 616 |
| « Golden rain » . . . . . | 26.87 | 28.6 | 623 | 27.23 | 27.5 | 753 |
| Imchinsä oats . . . . . | — | — | 768 | — | — | 784 |
| « Probstei » . . . . . | 26.64 | 32.4 | 533 | 28.07 | 32.3 | 641 |
| « Victory » . . . . . | 27.95 | 32.0 | 513 | 29.86 | 32.8 | 626 |
| « Ligovo » . . . . . | 26.4 | 35.1 | 503 | 24.47 | 37.5 | 554 |
| "Rykhlik", grown on the farm itself . . . . . | 19.35 | 34.9 | 630 | 25.31 | 32.9 | 620 |

967 – **Work in Tobacco Selection at the Experimental Station of Djember, Residence of Besoeki, Java, from 1912 to 1915.** — SPRECHER ANDREAS, in *Mededeelingen van het Besoekisch Proefstation*, Nos. 6-9-12-18. 1914 and 1915.

I. — PLANT IMPROVEMENT WORK. — This was undertaken in 3 directions, namely :

(*A*) Choosing among the races hitherto grown in the country types which answer the purpose in view to the best possible degree ;

(*B*) Introducing new races capable of competing advantageously with the old races of the country ;

(*C*) Production of constant hybrids combining the favourable characters of yield of different old types.

The tobacco plantations in the East of Java differing greatly as regards altitude, exposure, temperature, rainfall, humidity of the air, wind, soil, etc., it is obvious that the same race cannot everywhere answer the requirements of planters. For this reason, at least 3 races have been under cultivation for a long time in the province of Besoeki, apart from the first crosses which well informed planters send in large quantities every year to the European market where they meet with promising success, and the races cultivated by the natives for their own account. The latter sometimes supply a cheap tobacco very much in demand for the Rotterdam and Amsterdam markets, and above all they furnish the requirements of the country.

In view of the different races under cultivation, the manifold objects to be attained and the unequal conditions of plantations, it was clearly essential to have experimental fields in different places. The tobacco planters in the East of Java quite clearly realise this ; the new experimental Station at Djember therefore now possesses 4 experimental fields occupying an aggregate of about 30 acres, owing to which arrangement an examination may be made, at different altitudes, under different atmospheric conditions, and on varying types of soil (although all of volcanic origin), either of the lines selected from the races of the country, or of the first or subsequent crosses obtained on a rational method, or again foreign varieties and races.

Though it is not practicable to obtain 2 good tobacco crops from the same field in one year, it is nevertheless possible, when there is a sufficiency of land available, to carry out 2 plantings, one during the rainy season (January-April), the other during the dry season (August-November). In this way, the Djember Station every year carried out 2 plantings, even 3, the dryest months (June-August) being chosen for Turkish tobacco.

Owing to its not being found advantageous to plant tobacco every year on the same soil, some planters rotate their cultivations as follows : after a rice crop in May tobacco is put down (August-November), then again rice (January to May), then maize, soya or some other leguminous crop is planted, then once more rice, and it is then the turn of tobacco again after 2 years. It is a great advantage to be able to alternate cultivations, and the "sawahs" (paddy fields) are admirably adapted for growing tobacco in these tropical regions. The rivers which serve to irrigate the fields not only contribute a fair amount of fertilising silt, but besides this the water which remains on the fields for some time kills the many insects to be found in the soil, which insects might sometimes have disastrous effects in hot countries.

(A) *Choice of suitable Types.* — The selection of local races was begun with 120 parent plants, 55 being of the " Kedoe " race and the others

of the " Deli " and " Canarie " races. According to COMES, the 3 races are the result of crosses between the varieties *havaniensis* and *macrophylla* (*purpurea*) (1). The " Deli " race is finer and in a favourable climate yields cigar wrappers which are much in demand. The " Kedoe " race is not so fine, but is more aromatic and more vigorous, and does not require so much attention as the " Deli " race. It also sometimes furnishes wrappers for cigars of a less fine quality. The " Kedoe " plant presents some points of resemblance with one of the " Manilla " races, and that is alleged to be its origin. The " Canarie " race will stand more drought and heavy soils. In the East of Java it does not yield as good a tobacco as the " Deli " and " Kedoe " races, while in the Sultanates of Djokjakarta and Soerakarta, in the middle of Java, it is the only one cultivated and supplies a tobacco of dull appearance for cigar wrappers.

All the parent plants chosen in the autumn of 1912 in the different plantations were analysed on the methods set out in Bulletin No. 9. The results of this large task, however, are only public in respect to the " Kedoe " race which was the first to be studied. The analysis embraced the height of the plant, the number, shape, uniformity, venation and mutual position of the leaves. The following points of the first 15 leaves, green and dry, were studied for each plant: length, width, area, ratio between length and width and fineness, *i. e.* ratio between area and weight of leaves. Finally, for the dried leaves, the weight of the midrib was indicated, the ratio between the weight of the leaf and the rib, then the colour, determined by means of a scale of colours, and finally the burning qualities and the colour of the ash. In this way average values were obtained and also coefficients as to correlation which may serve as a standard of comparison for all subsequent studies in relation to the " Kedoe " race.

There was found: an inverse correlation between the number of the distance apart of the leaves; a direct correlation between the number of the leaves and the ratio of their length and width; a third, direct, between the weight of the leaf and the weight of the midrib; a fourth, inverse, between the weight of the leaf and the ratio between length and width; a fifth, direct, between length and width of the leaves and so on.

The methods hitherto adopted in laboratories in studying the combustion of tobacco have no practical bearing, in the writer's opinion, but may on the other hand serve for comparison of the different races and lines. The fineness of the tobacco, as well as its rapid and continuous combustion, depend mainly (questions of race apart) on the ripeness of the leaves, and in the second place on the drying and fermentation of the tobacco. Leaves which are too old and those which are too young exhibit the same faults: want of fineness and defective combustion. The reasons for these defects, however, are not the same in the two categories. In over-ripe leaves there is an excess of cellulose and woody substances; on the other hand, the over-

(1) The writer adopts in its entirety the system of tobacco classification of Italian writers. Thus the species *Nicotiana Tabacum* is subdivided into varieties, the varieties into races, the races into genotypes or pure lines and the lines into individuals.

young leaves contain too great a quantity of fats and albuminoids, which do not decompose to a sufficient degree during the fermentation of the tobacco.

In leaves picked at the right time, the mineral salts and organic substances are present in favourable proportions. In this condition of the leaf, the ferments in it are active, and it is these ferments which, during suitable fermentation of the tobacco, are capable of effecting transformation of the starch, sugars, cellulose, fats and albuminoids.

Unfortunately, the study of the lines chosen among the native races could not be continued each year in as thorough a way as was reported in Bulletin No. 9. Thus, in Bulletins Nos. 12 and 18 the different types are judged from the practical point of view only. For some lines of the races " Deli " and " Kedoe ", however, cultivated on two different fields, statistical study was carried a little farther as regards the height of the plants, the number and distance apart of the leaves, and also the number of leaves up to 1 metre height of the stalk. The results of this analysis are, *inter alia*, the following.

1) The field with more moisture and less sun, a less clayey and lighter soil, produced a greater length of stalk together with greater distance apart and size of the leaves, while the other field with less moisture, more sunshine, and a heavy and clayey soil, yielded more closely packed plants with more numerous and smaller leaves. The two races behave identically.

2) In both races, the lines with the greatest number of leaves up to 1 m. height are preferable from the quantitative and qualitative point of view. The types with leaves a short distance apart generally possess a larger number of leaves than others in which the spaces are wider, and where there are small spaces the leaves follow each other more regularly on the stalk, and afford better shade, so that when dry they exhibit a more homogeneous lighter and duller colour.

3) The seedlings chosen in the first place from the nurseries yield a finer plantation than the second or third choice of seedlings. All other things equal, backward seedlings will never yield in the open field tobacco plants as healthy and with as many leaves as strong seedlings. Seeds with feeble germs do not, even if the nurseries are manured, produce as strong adult plants as non-manured seedlings derived from strong embryos.

What is called the " Deli " race is a mixture of many genotypes. Several of these types have been under cultivation for years in the east of Java; for instance the " Deli-Palembang ", " Deli Toentoengan ", " Deli Besoeki ", " Deli-Arensburg ", etc. Even the " Deli-Medan ", however, is composed of several types, and the writer regards the " Deli " race as more variable than the " Kedoe " race. Though the difference may not always be easy to detect in the field, it is obvious on comparing the dry tobacco, and if the trouble is taken to mesure the plants it can be demonstrated mathematically. It is by measuring, counting and weighing certain properties of the phenotypes which for several generations represent the different genotypes, that a pure line may most effectively be distinguished from a population of types.

(E) *Introduction of New Races.* — About a hundred foreign races were planted during the three years in the different fields of the Stations. The seeds were obtained both from the experimental tobacco Institute of Scafati (Italy), and from the Department of Agriculture in Tokio (Japan). Among these exotic races, there were forty from Japan, others from the Balkans and Asia Minor, others again from the W. Indies, North and South America, etc. The results obtained are not encouraging, but it must not be forgotten that a single trial cannot be deemed sufficient.

Some by the Japanese races are distinguished by a fine leaf and a light colour, for instance " Hatano " (which has already been used for some years by growers in Besoeki for the production of hybrids), " Shinde " and " Satsuma ".

Turkish tobaccos (tobaccos from the Balkan countries and Asia Minor) grow fairly well, but the moisture of the air, even during the dryest months, is too much, which results in the leaves growing too large, too fine, and without sufficient aroma to form a good cigarette tobacco. It has not been possible up to the present, in spite of every care in gathering, drying and fermenting, to preserve the golden yellow colour of the leaves which characterises some Turkish tobaccos ; the most serious defect, however, is their weak aroma. Among the races which stand out favourably from the point of view of colour, aroma and combustion, mention may be made of : " Yaka-Kanthi ", " Yaka-Cavalla ", " Aya Solouk " and " Samsoun ".

The North American races proved not to be sufficiently resistant to fungus diseases ; those of Central America, the W. Indies and South America gave coarse tobaccos of a variegated and dark colour.

The " Bajesi " race of Hungary and another from Timor are distinguished for their vigour ; they find no difficulty in growing in poor soils and under unfavourable conditions of climate.

By continuous and persevering work foreign races presenting greater advantages might be found, but the writer, working on behalf of the planters, was anxious to obtain a practical result as speedily as possible.

c) *Production of Hybrids with fixed Characters.* — Numerous crosses were made with a view to improving both the quantity and the quality of the tobacco. By selecting from among the races of the country only, if they form populations comprising many lines, there is the likelihood of finding an advantageous type for cultivation. Once the pure line is obtained, however, any subsequent improvement could only relate to the methods of plantation manuring, cropping, drying and fermentation, as a pure line cannot be changed ; whilst by hybridisation there are obtained in the 2nd generation a multitude of forms, some of which combine the favourable characters of the parents, while others exhibit morphological or physiological, or again ecological characters which were by no means apparent in the parents. Seeing that planters expend fairly considerable sums every year for breeding experiments, it was clearly the duty of the experimental Station to look for types sufficiently constant for cultivation on a large scale. Judging from the results obtained, this is possible within three years, that is, after 6 generations.

II. — Diseases and Pests. — It cannot be said that there are any really serious diseases of the tobacco plant in the East of Java :

There is some small amount of fungous disease (*Phytophthora Nicotianae*, *Bacillus Solanacearum* Erw. Sm., *Cercospora Nicotianae* Ell. and Evr., etc.), but it occurs quite sporadically. More dangerous are the numerous insects (*Heterodera*, *Gryllus*, *Gryllotalpa*, the larvae of *Plusia*, *Heliothis*, *Prodenia*, *Lita*, and *Opatrum*).

The larva of *Lita solanella*, particularly, produces galls in the young plants which prevent normal growth. A rather serious disease is the mysterious " mosaic disease " which chiefly attacks fine-leaved races. In spite of many studies, it is not yet known whether this is a fungus disease or results from defective assimilation. Such defective assimilation certainly occurs, but is it caused by bacteria or by the soil, moisture or heat ? This problem will no doubt be better solved by laboratory experiments in which the external conditions can be minutely regulated. In the open field there are many factors which escape investigation, in spite of the most estensive weather observations. The importance of the latter, however, cannot be over-estimated, above all in the study of tobacco, and it is a great advantage to the Station of Djember that it possesses a meteorological installation in the vicinity of one of the experimental fields.

III. — Mutations. — The Author next deals with some rather interesting forms of mutation (or deemed to be such) :

There is for instance a form with a double flower, very pretty, with the outer corolla turned up, which has repeatedly been observed in Java. It is extremely rare, but breeds true in all its characters ; one double plant among the seed plants of a plantation is sufficient for it to reappear in the following generation, unless it is to be supposed that the same mutation can be repeated successively in different places. In Bulletin No. 12 a good reproduction of this very pretty flower is found.

Another variation is represented by the giant plants found in the Dutch East Indies among the races " Deli " and " Canarie ", but apparently not among the " Kedoe " race. Instead of forming a large inflorescence in panicle form after 3 months' growth, the top of the plant continues to grow, forming numerous small leaves in the axil of which there is sometimes, but rarely, a single flower. More frequent among the giants are the forms which reach great heights (16 feet and more) ; they mostly remain completely sterile or in some cases, after 8 months' growth, produce a few rare flowers. The writer found that these latter forms transmit their characters on a constant way, while other forms which do not always exhibit all the characters of the giant plants produce among their descendants 1, 15, 20, 21, 25, 31, 36, to 91 % of giant plants, according to various workers. Here the Author does not admit the term mutation, as he is of opinion that this term should not be applied unless the hereditary factors of the initial material have been examined thoroughly, which was not done with tobacco. The " Deli " race, for instance, seems to him to be made up of several special races transmitting their characters in a more or less constant way according to external circumstances.

Giant plants are explained by means of the theory of TSCHERMAK on the association and dissociation of "cryptomerous factors". According to this theory, the races which from time to time produce giant plants are forms with dissociated cryptomerous inherited factors, that is to say that the factors which transmit the height of the plants, the standard of size, the number and distance apart of the leaves, the period of growth, etc., are combined in such a way with the factors which transmit the abnormal height, many leaves and a longer period of vegetation, that there is no action of the one class of factors on the other under ordinary conditions. The characters of the giant plant being dissociated from those of the normal plant therefore remain under these cryptomerous conditions, and a normal plant is formed. If, however, owing to external circumstances the two categories of factors come into contact, then in the progeny giant plants in greater or lesser number form according to the intimacy of this contact.

The property which produces the giant is therefore made up of several factors : slow growth, indefinite growth of the main axis (leader), poor inflorescence, long period of vegetation, leaves much more numerous, less wide, etc. Each of these factors is presumed to be present in the normal plant, but dissociated from the normal factors, for which reason they have no influence on each other. If a partial association occurs, a transitional form results. For instance, if the factor for late flowering remains dissociated, then the giant plant flowers like an ordinary plant ; if the factor for slow growth remains dissociated, the plant develops as rapidly as a normal plant ; if, finally, the factors of an indefinite growth and of a defective inflorescence remain dissociated, there is only obtained a plant with many leaves of less width and smaller internodes, which for the rest, however, present nothing abnormal. A perfect association therefore produces giant plants exclusively, and a complete dissociation furnishes only ordinary plants.

Following the example of R. THOMAS, BATESON, G. HOWARD and FRUWIRTH, the writer also made experiments on parthenogenesis in tobacco. The negative results which he got invalidate those of R. Thomas and Bateson and confirm those of G. Howard and Fruwirth (1).

All growers know how frequent are anomalies in the tobacco plant. The writer found golden-yellow types and others which were variegated in every degree ; there is often fasciation of the stem and epiascidia and hypoascidia occur in the leaf.

Tobacco seeds kept in airtight bottles retain their germination capacity in the tropics for 7 years at least. Germination experiments undertaken to elucidate the question whether the specific gravity affects the germination rapidity and capacity have shown that seeds which float in a solution of

(1) Continuining these investigations the writer has since obtained positive results. A Japanese race ", Okonawa ", with white flowers, shady leaves and very lengthy period of vegetation produced fruits and seeds without pollination. The fruits are perfectly normal, but the seeds have not yet been studied. It this may not be a definite case of true parthenogenesis at any rate the seeds have well developed integument.

sugar of 12.5 % germinated better than those which sink in this solution. In the latter the seed covers appear to have increased in thickness and weight at the expense of the germ. Those which remained at the surface of the water germinated less than those of the others. (Bull. No. 12).

AGRICULTURAL SEEDS

968 – **A new Method of Determining the Impurity of Cereal Grains, caused by the Presence of Seeds of *Agrostemma Githago*** (From the Work of the Seed-testing Station at Kharkov, Russia). — JANATA A., in *Южно-русская сельско-хозяйственная Газета*. (The Agricultural Gazette of Southern Russia), XVIIth Year, No. 47, pp. 6-8. Kharkov, December 1915.

*Agrostemma Githago* causes damage of two kinds: it infests the fields, and its seeds, mingled with cereal grains, impart to the latter, and the flour manufactured from them, properties which are injurious both to men and animals; it is not yet definitely known what is the origin of this injurious action, but in spite of this, " under conditions in connection with army supplies ", the only conditions recognised by law in Russia, and which serve as a basis for the purchase of cereals, it is provided that the seeds of *A. Githago* may not exceed 0.06 % in weight.

In view of this low percentage, very delicate scales are required to determine it by weight, and also practice in handling them, which forms a serious obstacle to the enforcement of the regulations. With a view to devising an easier and more practical method, experiments were carried out on oats, barley, rye and wheat grains from both small and large farms in 11 districts of the government of Karkov, in order to determine the average weight of the seeds of *A. Githago*, with the object of using the weight so determined in ascertaining the degree of impurity of the grains.

The results of the experiments were as follows :

The total number of seeds of *A. Githago* weighed was 1 820, and the average weight of one seed was 0.0101 grms., but the weight of each seed fluctuated between 0.0128 grms. and 0.0056 grms.

No relation was observed between the weight of the seed of *A. Githago* and the description of cereal or the locality from which it had been taken.

On the other hand, the influence of another factor, the class of the farm, appears to affect the weight of the seeds of *A. Githago*. This rate is rather higher for big farms than for small ones. Considering, however, that this difference is very small and does not exceed the limits of fluctuation in the weight of seeds coming from each of the different classes of farm, the writer takes the view that in practice the average weight of a seed of *A. Githago* may be assumed to be equal to 0.01 grms. for all farms.

Taking this average weight as the basis, it is easy to pass from the number of seeds of *A. Githago* in 100 grms. of grains, to their percentage by weight. If, however, the legal percentage of impurity mentioned above is considered, it is easily seen that in 100 grms. of grains, the number of seeds of *A. Githago* should not exceed 6. The introduction of the numerical method will greatly facilitate the technique of testing the purity of the grain as regards its content in seeds of *A. Githago* This method would also be of use in control measures against this weed.

Possibly subsequent researches may, on various grounds, modify

the average weight found, but according to the writer they cannot invalidate the rational character of the numerical method which he has proposed for practical objects.

CEREALS AND PULSE CROPS

969 – **Liquid Manure with Addition of Sulphuric Acid as Spring Manure and Means of Control against Weeds and Lodging of Wheat. Sulphur treatment against the Parasites of Lodged Wheat.** — GIGLIOLI ITALO, in *Bollettino della Società degli Agricoltori Italiani*, Year XXI, No. 9, pp. 257-266. Rome, May 15, 1916.

As early as 1872, LUDWIG KOCK demonstrated experimentally that predisposition to lodging in cereals must be attributed to insufficiency of light during the first few months of growth of the plant, which insufficiency weakens or entirely interrupts the chlorophyll function, besides promoting an accumulation of water in the culms and leaves, which leads to the rapid lengthening of the weakened plant. The result of this is an exuberant growth of the wheat. In the first period of development the growth of the wheat is very dense ; the weeds, which thrive under the shade of the wheat, belong to those species which are adapted to requiring the least quantity of sunlight and which, forcing their roots downwards in the soil more rapidly than wheat, thus find conditions favourable to their development, which still further increases the shortage of light from which the wheat suffers. Moreover, overcast weather, the crowding of the wheat stalks, the want of light and the humidity due to the weeds which cannot be successfully extirpated, favour the growth of parasitic fungi which attack and weaken the watery and soft culms of the wheat at their base.

The conditions in the spring of 1916 were such (wet season with frequent wind, sky often overcast and unsteady weather) that lodging of the wheat was apprehended, and the writer therefore desired to ascertain the causes of this phenomenon, and on the basis of his own experiments and the results of the chemical method for controlling the weeds which infest wheat, he also desired to suggest suitable remedies against lodging.

Farmers in general blame fertility of the soil and excess of manure for immoderate growth of the wheat with consequent lodging, but the Author asserts that it is not the natural or artificial fertility of the soil which directly leads to the lodging of wheat, as he frequently found, for several years in succession, on the experimental field of Suessola (though this field is abundantly and even excessively manured), that wheat never lodged near the edges of the many plots (these were 123), where the plants had a better exposure to the sun, while they were all lodged in the centre of the plot where the vegetation was too crowded. Similar observations, to the effect, namely, that an abundance of nitrogenus manure in the soil does not always produce lodging of grain crops, were made a number of years ago by T. POGGI in Polesina. It follows that in wheat growing the farmer need not be too much concerned at an abundance of manure, provided he prevents the young plants undergoing a rapid and crowded growth which would directly deprive them of light, and takes care to destroy the growth of weeds in good time. The first object may be secured by all such measures as ensure the young wheat the best of all « fertilisers », namely sunlight. With this object in view, the sowing should not be too close or too early, especially if

the soil is very fertile owing to recent manuring of immediately preceding crops intended to enhance its fertility. Sowing should not be done closely and broadcast, but rather in rows or ridges, which increases the light available for the wheat, and also allows of proper weeding and superficial tillage at the beginning of spring, so that between the rows the soil remains perfectly clean and under favourable conditions of aeration. The very old practice of topping wheat when too high, or feeding it to sheep for a short space of time, is a method by which the lower part of the culms may be made to benefit by the reinvigorating and wholesome effect of sunlight.

With regard to the destruction of weeds in good time, in consideration of the results obtained in France, England and Scotland by spraying the wheat (with sulphate of copper, or, according to M. RABATÉ, with dilute sulphuric acid) as a direct method of weed prevention, and on the basis of the experiments carried out by himself in the experimental field of Suessola with human urine to which sulphuric acid had been added, used as a nitrogenous manure, the writer proposes to modify the RABATÉ method of spraying wheat with dilute sulphuric acid, and to combine the treatment for weed control and the destruction of parasitic fungi with the spring nitrogenous manuring. This treatment would be carried out with urine acidified by sulphuric acid, which should be put down as a cover on the wheat, in the spring, and repeated several times if possible, by means of sprayers, as is at present done with sulphate of copper and the ordinary dilute solution of sulphuric acid.

The only economic method of conserving urine is based on mineral salts. The writer has always stressed the importance of agricultural utilisation of human and animal urine, pointing out that urine contains a quantity of nitrogen five times greater (4.40 kg. as against 0.80 kg.) than that existing in solid excrement. He adds that at the present time almost the whole of this urine is wasted, and that in Italy the annual loss may be estimated at 300 million francs.

Passing on to deal with his experiments in manuring with human urine plus sulphuric acid, which were carried out at Suessola, the writer states that this manure was applied with success during the 18 years of continuous cereal growing, two grain crops being taken each year, maize following wheat in the same year. In the course of the successive years, variable quantities of acidified urine were employed, the most usual proportions being 320,249,223 and 178 gallons per acre. The acid solution was in some years applied in the autumn before the wheat was sown, but in most instances it was spread in the spring. The leaves of the wheat were slightly burnt by the drops of caustic liquid, but the wheat rapidly recovered and gave a fine yield.

Taking into account the experiments conducted of late years on the beneficial action of sulphur, particularly in respect to organic soils and different cereal crops on the one hand, and the fungicidal action of this product on the other hand, the writer, in case of vigorous growth of fungal parasites on wheat during the ripening period, advises the sulphuring of

the young wheat with the object of preventing and combating this danger, and at the same time contributing to the soil a substance capable of producing a fertilising action for subsequent crops. Probably the useful action of sulphur in the soil is an indirect one, in which the sulphur, by modifying the microflora and microfauna of the soil, renders the latter more fertile.

As a result of these considerations, the writer proposed to the " Società degli Agricoltori italiani " in Rome to organise co-operative experiments in the spring of 1916, on plots of 50, 120 or 240 sq. yds., chosen in the wheat fields where there is most reason to apprehend lodging and its consequences, in order that farmers might form an exact opinion about the measures proposed for the prevention and mitigation of the injuries due to lodging of cereals. The experiments were to be organised as follows :

I. — EXPERIMENT IN THE USE OF ACIDIFIED HUMAN URINE, APPLIED AT THE RATE OF 220 GALLONS PER ACRE. — The urine will be prepared by collecting it in carboys or vats tarred inside, in which concentrated sulphuric acid is mixed with the urine in a quantity corresponding to 6 pints of acid per 100 pints of undiluted natural fresh urine. The mixture will occasionally be stirred up in order that the entire mass of the liquid may be acidified, and to prevent any fermentation. The spraying (which in small experiments, may be made by brush application) will be carried out in the spots where the wheat is very high, particularly where weeding has not been successful in sufficiently preventing weed growth. In case of need, where wheat suffers greatly from want of light, the treatment may be repeated a second time of an interval of one week or more, but before the wheat emerges from the glumes. For the second treatment, the acified urine might be diluted with an equal volume of water.

II. — EXPERIMENTS IN TREATING WHEAT WITH FLOWERS OF SULPHUR. — Flowers of sulphur (sublimated flowers of best quality) being more readily oxidisable by the slow action of the air and light, should be preferred to sulphur which has been first melted and then ground. Treatment with sulphur should be tried in those places where the wheat stalks are crowded, in moist localities, particularly when the bases of the culms are seen to exhibit a tendency to blacken. The amount applied should be 178 lbs. per acre. This application must be repeated in case of lodging of the wheat, and more especially if a progressive invasion of fungi is observed. As in the case of the vine, the treatment must be carried out in hot and clear weather, with no wind. When the wheat is flowering treatment with sulphur would be out of place, but it can be done before or after. The wheat crop having been got in and weighed, it should be ascertained whether the treatment has rendered the soil more fertile for the crop next in rotation.

970 - **Action of Ammoniacal Salts on the Growth of Barley.** — SODERBAUM H. G., in *Kungl. Landtbruks-Akademiens Handlingar och Tidskrift*, LVth Year, Nos. 1-2, pp. 57-66. Stockholm, 1916.

Ammoniacal salts applied to soil under grass or grain crops, and manured with phosphates of low solubility (bone meal, tricalcic phosphate or phosphorites) give better results than sodium nitrate. Barley is an exception to this rule as it seems to take more readily to nitrates. A special

series of investigations was undertaken by the writer with the specific object of studying and explaining this special behaviour of barley. The article sets out the results of these experiments. 84 glass vessels were used, 50 cm. high and 25 cm. in diameter, each containing 28 kilograms of sandy soil, plus 1.17 grms. of potassium chloride and 0.50 grms. of sodium chloride, which corresponds to 134 lbs. of $K_2O$ per acre. They were divided into 3 groups of 27 vessels each, manured with 3 different kinds of phosphates: superphosphate, basic slag and bone meal, in the respective proportions of 3.65 grms. 7.27 grms. and 3.45 grms. per vessel, which corresponds to 134 lbs. of $P_2O_5$ per acre. To each phosphate there was afterwards added one of the 3 nitrogenous manures: sodium nitrate, ammonium chloride and ammonium sulphate, in the proportions of 4.50 grms., 2.80 grms. and 3.48 grms. respectively, which corresponds to 134 lbs of nitrogen per acre.

Each group of 27 vessels was thus in turn subdivided into 3 groups of 9, differing in the nature of the nitrogenous manure; these 9 vessels were finally divided into 3 groups of 3, one of which received no further treatment, while the other 2 received an addition of magnesium sulphate and magnesium carbonate (magnesite) respectively, in the proportion of 1 grm. and 3.44 grms. Finally three pots were manured with nitrate of soda, without phosphates.

The barley was sown on the 4th May 1915 and the first seedlings appeared on the 11th. Towards the end of the same month, in the series: superphosphate, ammoniacal salts, sulphate of magnesia, it was observable that the leaves were yellowing and a stoppage of growth was taking place, followed in some instances by the death of the plant. These pathological symptoms developed with greater intensity in the case of the ammonium chloride, and less strongly in the presence of ammonium sulphate. When, however, the crisis had once been successfully passed, the plants started growing and developing again normally. In the series: superphosphate, ammoniacal salts, magnesium carbonate, no pathological effect was observed. The crop, collected on the 12th Augusr, gave the results set out in the Table annexed.

The figures compiled in the Table confirm what was already perfectly obvious 3 weeks after sowing. Both in the superphosphate and in the bone meal series, the ammoniacal salts produced results inferior so those brought about by nitrate, and this difference is still more notable if the superphosphate alone is taken into account. Taking as equal to 100 the crop obtained by the use of nitrate, we have for the ammoniacal salts an average of 90 to 80, dropping even to 60 in unfavourable cases. It is interesting to note that with ammonium chloride better results are obtained on the whole than with sulphate, in spite of the serious symptoms of poisoning met with in the early phases of growth of the seedlings. In the series: bone meal, ammoniacal salts, the magnesium carbonate raises the yield, while in the series: bone meal, nitrate of soda, it causes a marked diminution.

If we now examine the basic slag series, the picture presented is quite a different one. All the differences, more or less marked, between the

| | Results of Experiments. Yield for each vessel in grams | | | | | Taking the yield obtained with phosphate and nitrate of soda as equal to 100, the result is: | | |
|---|---|---|---|---|---|---|---|---|
| | Total | Grain | Straw | Weight of 1000 grains | Ratio Straw: grain | Total yield | Grains | Straw |
| | g | g | g | g | | | | |
| Nitrate of soda | 3.9 | 0.5 | 3.4 | 20.8 | 6.800 | — | — | — |
| *Superphosphate:* | | | | | | | | |
| Nitrate of soda | 62.4 | 31.7 | 30.7 | 37.2 | 0.968 | 100.0 | 100.0 | 100.0 |
| Nitrate of soda + sulphate of magnesia | 68.9 | 34.0 | 34.9 | 36.7 | 1.026 | 111.1 | 107.3 | 115.3 |
| » » + carbonate » | 61.9 | 31.9 | 30.0 | 35.3 | 0.940 | 99.1 | 100.6 | 97.4 |
| Ammonium chloride | 13.4 | 7.2 | 6.2 | 25.4 | 0.861 | 16,0 | 21.4 | 10.2 |
| Ammonium chloride + sulphate of magnesia | 15.6 | 8.7 | 6.9 | 26.0 | 0.793 | 20.0 | 26.2 | 12.8 |
| » » + carbonate » | 53.1 | 29.8 | 23.3 | 31.9 | 0.781 | 84.1 | 93.9 | 72.8 |
| Sulphate of ammonia | 8.9 | 4.0 | 4.9 | 20.0 | 1.225 | 8.5 | 11.2 | 5.4 |
| Sulphate of ammonia + sulphate of magn. | 9.8 | 4.7 | 5,1 | 21.8 | 1.085 | 10.1 | 13.4 | 6.2 |
| » » + carbonate » | 59.2 | 33.6 | 25.6 | 33.0 | 0.761 | 94.5 | 106.1 | 81.3 |
| *Basic slag:* | | | | | | | | |
| Nitrate of soda | 66.8 | 33.9 | 32.9 | 34.2 | 0.970 | 100.0 | 100.0 | 100.0 |
| Nitrate of soda + sulphate of magnesia | 66.4 | 33,9 | 32.5 | 35.7 | 0.958 | 99.3 | 100.0 | 98.6 |
| » » + carbonate » | 65.6 | 33.9 | 31.7 | 35.2 | 0.935 | 98.1 | 100.0 | 95.9 |
| Ammonium chloride | 65.3 | 35.0 | 30.3 | 32.5 | 0.865 | 97.6 | 103.2 | 91.1 |
| Ammonium chloride + sulphate of magnesia | 67.6 | 36.1 | 31.5 | 33.5 | 0.872 | 101.2 | 106.5 | 95.2 |
| » » + carbonate » | 67.8 | 36.8 | 31.0 | 34.5 | 0.842 | 101.5 | 108.6 | 93.5 |
| Sulphate of ammonia | 64.4 | 34.2 | 30.2 | 37.3 | 0.883 | 96.1 | 100.9 | 90.8 |
| Sulphate of ammonia + sulphate of magn. | 66.5 | 35.5 | 31.0 | 36.5 | 0.873 | 99.5 | 104.7 | 93.5 |
| » » + carbonate » | 63.4 | 33.3 | 30.1 | 39.0 | 0.904 | 94.5 | 98.2 | 90.5 |
| *Bone Meal:* | | | | | | | | |
| Nitrate of soda | 53.6 | 25.2 | 28.4 | 27.9 | 1.126 | 100.0 | 100.0 | 100.0 |
| Nitrate of soda + sulphate of magnesia | 46.0 | 21.1 | 24.9 | 26.5 | 1.180 | 84.7 | 83.4 | 86.0 |
| » » + carbonate » | 28.7 | 11.3 | 17.4 | 21.6 | 1.539 | 49.9 | 43.7 | 56.0 |
| Ammonium chloride | 28.3 | 16.5 | 11.8 | 31.7 | 0.715 | 49.1 | 64.7 | 33.6 |
| Ammonium chloride + sulphate of magnesia | 21.5 | 12.3 | 9.2 | 29.1 | 0.748 | 35.4 | 47.7 | 23.2 |
| » » + carbonate » | 43.8 | 23.1 | 20.7 | 28.0 | 0.896 | 80.2 | 91.5 | 69.2 |
| Sulphate of ammonia | 18.1 | 10.5 | 7.6 | 22.4 | 0.723 | 28.5 | 40.4 | 16.8 |
| Sulphate of ammonia + sulphate of magn. | 18.1 | 10.3 | 7.8 | 22.9 | 0.757 | 28.5 | 39.6 | 17.6 |
| » » + carbonate » | 47.4 | 24.7 | 22.7 | 27.3 | 0.919 | 87.5 | 97.9 | 77.2 |

ammoniacal salts and nitrate, between the sulphate and carbonate of magnesium, and between the different ammoniacal salts, tend to disappear.

In some cases the ammoniacal salts may produce a crop equal to that obtained with the nitrates, and if, under many other circumstances, the nitrate still retains an indisputable superiority, the fact is probably due to a poisonous action of ammoniacal salts on the growing seedlings. An explanation has been offered for the specifically favourable action of the ammoniacal salts by connecting it with the acid physiological character of the latter. Both in the chloride and the sulphate, the cation $NH_4$ is alone absorbed and utilised by the plant, while the anions Cl or $SO_4$ are only partly fixed, and hence there results a progressive increase of acidity in the plant substance, which is quite sufficient at this stage to produce an action injurious to growth. On these lines the favourable effects of magnesium carbonate in the series : phosphates, ammoniacal salts, might be explained, as likewise the superiority of the slag with large lime contents over the other phosphate manures, etc. All that is here in operation would be merely the neutralising power of the two carbonates, that of magnesia and that of lime.

The following facts however conflict with this hypothesis :

1) The sick plants were young ones, and so small as yet that it cannot be certain that they had absorbed nitrogen to an extent capable of noticeably influencing the composition of their substance.

2) If the weight of the dry substance of the 3 weeks old seedlings which grew in one vessel be taken as equal to 6 grms., there will be in all about 24 grms. of green substance. Out of 24 grms. of fresh substance there is 0.144 grm. of nitrogen, corresponding to 0.375 grm. of hydrochloric acid, which would require 0.51 grm. of calcium carbonate for its neutralisation. Bone meal, however, contains calcium carbonate in the proportion of 1.26 grms, more than twice what is required, and in spite of this it does not suffice alone to counteract the injurious action of the ammoniacal salts.

3) Finally, it was observable that ammonium nitrate, though physiologically a perfectly neutral salt, produces the same effects as magnesium chloride and sulphate, though to a less extent.

Thus the hypothesis of a progressive acidification of the substance of the plants must be dismissed, and it is more in keeping with the facts to assume that what really takes place is a poisonous action of the ammoniacal salts exerted direct on the plant.

Recent experiments appear to show that the carbonates of calcium and magnesium promote the processes of nitrification by bringing about the transformation of the injurious ammoniacal salts into nitrates which are not injurious : hence their beneficial action.

971 - **Oat-growing in the State of Washington, United-States.** — SCHAFER E. G. and GAINES E. F., in *State College of Washington, Agricultural Experiment Station, Pullman, Washington, Bulletin* No. 129, 13 pp., 3 fig. Pullman, March 1916.

After wheat, oats are the most important grain crop cultivated in the State of Washington. During the ten-year period which closed in 1914, the average annual production was 11 629 253 bushels ; the average area oc-

cupied for the same ten-year period was 242 831 acres: the average yield 47.9 bushels per acre. Both the area under oats and the average unit production are in continual increase.

The major part of the oats produced by this State is grown in two widely separated districts: the county of Skagit in the western part, and the counties of Spokane and Whitman in the eastern part.

A study of the conditions peculiar to those sections where oats are grown in large quantities indicates that they thrive better in a rather moist climate. Trials for determining the quantity of moisture required by the different cultivations showed that oats in order to produce a unit of weight of dry substance, require more water than does barley or wheat. The maximum unit yields are obtained where the vegetative period is long and comparatively cool.

Table I sets out the characters of the most important varieties of oats in the State of Washington. They are determined from plants grown at Pullman. Table II indicates the unit productions obtained from the best varieties in open field experiments at Pullman.

TABLE I. — *Characteristics of the principal varieties of oats grown in the State of Washington.*

| Variety | Height of plant | Rigidity of straw | Shape of panicle | Colour of grains | Nomber of grains per 5 g | Percent of hull | Weight per bushel | Date of ripening |
|---|---|---|---|---|---|---|---|---|
| Abundance . . . | 49.7 ins | 93.9 % | spreading | white | 196 | 29.8 % | 39.0lbs | 9 August |
| Banner . . . . . | 48.7 | 89.9 | » | » | 198 | 28.4 | 39.7 | 8 » |
| Sparrowbill . . . | 48.9 | 86.9 | » | » | 144 | 29.5 | 42.0 | 7 » |
| Swedish Select . | 28.0 | 86.9 | » | » | 162 | 27.5 | 41.7 | 7 » |
| Sixty Day . . . | 41.4 | 87.2 | » | light yellow | 259 | 25.7 | 35.7 | 25 July |
| Danish . . . . | 50.2 | 87.3 | compact | white | 190 | 27.4 | 39.0 | 13 August |
| Potato . . . . . | 46.7 | 95.2 | spreading | » | 228 | 27.0 | 37.7 | 11 » |
| Grey . . . . . | 52.2 | 86.4 | side panicle | dark grey | 162 | 29.9 | 40.7 | 4 » |
| Regenerated Swedish Select . . | 49.9 | 92.2 | spreading | white | 180 | 26.3 | 42.3 | 6 » |
| Palouse Wonder | 50.9 | 89.4 | » | » | 171 | 24.9 | 41.7 | 7 » |
| Dun . . . . . | 49.4 | 81.3 | » | » | 186 | 24.3 | 41.0 | 9 » |
| Madison . . . . | 49.8 | 89.2 | » | » | 176 | 25.5 | 42.0 | 7 » |
| Canadian . . . | 49.6 | 91.9 | » | » | 183 | 29.1 | 45.3 | 1st » |
| Lincoln . . . . | 49.7 | 91.1 | » | » | 177 | 28.2 | 46.0 | 30 July |
| Yielder. . . . . | 48.4 | 92.0 | » | » | 166 | 27.9 | 41.3 | 7 August |
| Hulles . . . . . | 42.6 | 86.9 | » | » | 387 | — | 52.0 | 13 » |

TABLE II. — *Yield of some varieties of oats (averages of the 1914 and 1915 crops) and comparison between their Cropping Powers.*

| Variety | Bushels per acre average | Comparative yield * |
|---|---|---|
| Abundance | 81.7 | 111.9 |
| Banner | 78.3 | 107.3 |
| Sparrowbill | 76.5 | 104.8 |
| Swedish Select | 78.2 | 107.1 |
| Sixty Day | 77.2 | 105.8 |
| Danish | 65.4 | 89.6 |
| Potato | 65.9 | 90.3 |
| Grey | 64.0 | 87.7 |

* Taking as 100 the average of all varieties, which was 2 336 lbs. per acre.

972 - **Destruction of the Bean Germ.** — BUSSARD, in *Comptes Rendus de l'Académie d'Agriculture de France*, Vol. II, Year 1916, No. 19, pp. 550-551. Paris, 1916.

A method was required of destroying bean embryos without injury to the cooking value of the seed. The experiments covered three varieties: Algerian white, black and red beans. The experiments proved that when only a few seeds are concerned, immersion for one minute in boiling water is sufficient to deprive seeds which were previously capable of germinating in the proportion of 95 % of all germination capacity. When dealing with several pounds it will be prudent to prolong the immersion for 4 to 5 minutes. This time should not be exceeded, to prevent any cooking action being begun. The scalded beans, on drying in the open air, by spreading them in a thin layer on a flat surface, rapidly give up the water they have absorbed. Within 24 to 28 hours the bean appears to be perfectly dry, slightly wrinkled, and rather duller than the normal. It possesses very good keeping properties, and its cooking qualities are not impaired.

973 - **Some Factors affecting the Cooking of "Dholl" (*Cajanus indicus*).** — VISWANATH B., LAKSHMANA T. ROW and RAGHUNATHASWAMI AYYANGAR P. A., in *Memoirs of the Department of Agriculture of India, Chemical Series*, pp. 149-163, tables 6. diagrams 4, Calcutta, April 1916.

"Red gram" or "Pigeon pea" (*Cajanus indicus*) is grown in India as a food substance, which, in Southern India, is one of the products resorted to by vegetarians in order to increase the nitrogenous content of foods with a rice basis. While peas and other pulses are cooked fresh, the "red gram" is gathered when ripe, is dried in the sun and husked, the grains forming *dholl*, which is cooked and eaten. In the South, the grains after drying are mixed with red earth and water, they are left for one night in this mixture and are then dried in the sun before husking.

The writers have investigated the effect of the composition of the water on cooking. They made use of waters the content of solid matter in which ranged from 0 to 1 225 per 100 000. They observed that the presence of dissolved salts in the water largely affects the time required for cooking, which is longer in the case of salt-charged waters. Furthermore, the adding of bicarbonate of soda, which is commonly done in the South of India, reduces the time of cooking. The rapidity of cooking depends therefore on the one hand on the quantity of dissolved salts and on the other hand on the nature of those salts.

The method which consists in determining the time of cooking is a very primitive one however, which can only give approximate results. The writers adopted a different one based on a measurement of the quantity of starch substance dissolved during cooking. In addition to this weight of starch which passed into solution, they determined the weight of the dry substance of the *dholl* before and after boiling, as well as that of the nitrogenous substances in the *dholl* before and after boiling. The experiments showed that some salts, such as the salts of calcium and magnesium, sodium chloride and hydrochloric acid, sulphates and carbonates reduce the rapidity of cooking, the reduction being approximately proportional to the concentration of the salts. On the other hand, alkaline carbonates and alkalies produce an acceleration. The substances which accelerate cooking most are those which exert a greater solvent action on the albuminoid substances as compared with the starch, which points to the definitive conclusion that the rapidity of dissolution of the albuminoids forms the determining factor.

The writers also made it their work to ascertain whether the accelerating agents did not act by saponification of the fatty substances. They found that the fat content of the dholl exercises but very little influence, if any, on the rapidity of cooking. They furthermore observed that the practice of treating the gram with red earth and water entails quite a marked delay in the rapidity of cooking ; this treatment however is of advantage because it enables the gram to be more easily broken and husked. Finally, they studied the influence of different salts on the liquefaction of starch, utilising rice starch purchased as pure and passed through a 100 mesh sieve ; they found that, among the substances used, only caustic potash increases the quantity of liquefied starch, as compared with pure water ; this quantity is on the other hand reduced by the other products tried, hydrochloric acid, carbonates of sodium and calcium, sulphates of sodium and magnesium, chlorides of sodium, magnesium and calcium.

974 – **Comparative Experiments in the Growing of some Varieties of Potato at the Scientific Agricultural Station of Flahult, Sweden.** – Von Feilitzen Hjalmar, in *Svenska-Mosskulturföreningen Tidskrift*, Year XXX, No. 2, pp. 119-123. Jönköping, 1916. STARCH CRO

Experiments in sandy and peaty soils with the following varieties of potatoes :

*Early* : Lucya, Midsommar, Harbinger, Juni, Atalanta, Admiral, Nieuwe Muizen ; *Fairly early* : Mossros, Svalöfs 2171 and 3101, Geheimrat Haas, Enorm, Svalöfs 2031; *Rather late*: Gertrud, Non plus ultra, The Faktor, Makalös, Up to date, Höganäs, Freiherr von Wangenheim,

Svalöfs 3 (d'Eldorado), Jubel, Union, Danusia, Svensk Gamda röda, General Cronje, Svalöfs 72 (de Magnum bonum), Hoit Jämtlandspotatis, Eldorado, New Guardian, Hassia, Roode Star : *Late* : Juvel and Böhms Erfolg ; *Very late* : Switez and Svalöfs 1189.

The yield of potatoes was on the average very high: 11.94 tons per acre. Gertrud leads with 18.1 tons, after come Lycya, Mossros and Juvel, with 17 ; 16.4 and 16.2 tons respectively.

In the different groups, the best results were obtained with the following varieties :

Lucya 17 ; Midsommar 13.9 ; Harbinger, 11.9.
Massros 16.3 and Svalöfs 2171, with 14.9.
Gertrud 18 ; Non plus Ultra 15.84 ; The Faktor 15.76 ; Makalös 14.85 and Up to date 14.85.
Juvel 16.25.
Switez 11.2.

The proportion of small tubers averages 9.1% with a maximum of 20.9 % for Gamba Svenska roda, and after this New Guardian, 19.6 ; Nieuwe Muizen, 17.9 and Boode Star, 17.2 %. The average starch content for the different varieties is shown by the following table :

| Varieties | Maximum | Minimum | Average |
|---|---|---|---|
| Early | 15.55 % | 12.93 % | 13.57 % |
| Fairly early | 16.93 | 13.00 | 14.93 |
| Rather late | 17.85 | 13.13 | 15.23 |
| Late | 17.65 | 16.73 | 17.19 |
| Very late | 18.55 | 17.45 | 18.00 |

The leading position is taken by Switez, with 18.55 % ; next come Roode Star (17.85), Erfold (17.65), Cronje (17.60), Svalofs 1189 (17.45). Non plus Ultra (17.35), Gertrud (17.28) and Makalos (17.03 %).

The following figures in respect to the connection between the nature of the soil and the starch content are of some interest :

| Varieties | Peaty soil | Sandy soil | Sand with little humus | Pure sand |
|---|---|---|---|---|
| Early | 12.96 | 14.02 | 13.65 | 13.66 |
| Fairly early | 13.77 | 15.05 | 15.37 | 15.45 |
| Rather late | 14.32 | 14.97 | 15.70 | 15.95 |
| Late | 15.55 | 17.60 | 17.45 | 18.15 |
| Very late | 15.85 | 18.70 | 18.65 | 18.80 |

The percentage of starch therefore increases when the humic substance is reduced. The maximum yield of starch per acre was obtained with Gertrud (7 000 lbs) ; after which come Non plus Ultra (6166), Juvel (6080), Makalös (5671) and Wangenheim (5371 lbs per acre).

It is proposed to continue these comparative experiments for 4 years longer.

975 - **Economic Desirability of Tree Planting in Grasslands.** — SPIRIDONOV N., in *Земледѣльческая Газета* (*Agricultural Gazette*), No. 12 (128), pp. 310-311. Petrograd, March 1916.

Observations effected during a period of 25 years on more than 44 hectares of the zone of "grey earths" in Russian Europe, highly suitable for sylviculture (1). The above area was divided into 18 meadows, part of which was already free from trees when purchased; the remainder being sown, the trees being retained as far as possible. The soil is peaty, sandy or "podzol".

During two or three periods of great drought, the value of the treeless grasslands fell off 12 to 50 %, while that of the grasslands planted with trees increased 16 %. In rainy years, the latter exhibit much better vegetation than that of grasslands without trees.

At the beginning of the period of utilisation the treeless grasslands were the best as regards vegetation; about 12 years afterwards however the composition and appearance of the vegetation suddenly grew worse, and at the present time (25 to 30 years after) these grasslands have the aspect of moorland covered with *Nardus stricta* L. Tillage, manuring and sowing with good forage crops were not effective in producing a permanent improvement of these grasslands.

The turf layer was broken up at a suitable moment, and the grasslands were ploughed, after which various crops were sown but the result obtained was always the same. In the first year the grassland produced 35.8 cwt of hay per acre containing 80 % of leguminous plants; in the 2nd year it produced about 17.9 cwt. of hay in which Gramineae predominated; in the 3rd and 4th year the crop became poor; it afterwards fell off rapidly to such an extent as to be below that of the uncultivated grasslands.

In the grasslands planted with leafy trees (in this case birches) the vegetation begins to improve towards the 12th year after they have begun to be utilised, and attains its maximum development between the 16th and the 20th year. Then, when the tops of the trees are in contact as well as their roots, there is a rapid retrogression: vegetation becomes sparser, the leguminous plants disappear and the crop suddenly declines. If however during this period the trees are felled, there is for 3 or 4 years a fine hay crop, rich in *Lathyrus pratensis, Trifolium montanum,* and, it appears, in *T. incarnatum.* This operation however is not desirable. It is better to rest content with poor crops for 6 to 8 years (which crops, however, never fall below the level of those yielded by *Nardus stricta* in the treeless grasslands), after which the trees are felled. After 28 years, each birch tree, according to the writer's investigations, yields 2.8 cubic metres of wood apart from branches. In short, these observations hold out the prospect of obtaining at the same time a wood which, at the rate of 144 trees per acre, will yield in about 28 years 400 cubic metres of wood and also good hay crops.

(1) The "grey earths" of the wooded and steppe zone form the transition from the "podzol" zone to that of "tchernoziom". They precede the steppes. In European Russia their width ranges from 62 to 124 miles. (*Ed.*)

The above observations relate to grasslands very irregularly planted with birch trees, the roots of which spread out near the surface of the soil and deprive it of moisture. When the roots of neighbouring trees interlace in the 20th year, the falling off in the hay crop is probably due to shortage of water. If, however, instead of birches the grassland is planted with deep-rooted alders, this phenomenon does not take place. Round about the alders the vegetation is of better appearance than round the birches, and is higher ; it extends right up to the tree trunks without any reduction in height or change in colour, while around the birches circles of weaker and discoloured vegetation form which extend in the course of time. With regard to the greater care required by the upkeep of high forest alders as compared with that demanded by birch trees, the desirability from the economic point of view of planting grasslands with alder is brought out clearly : with 220 alders per acre a good high crop may be maintained without manuring and without any hindrance to the growth of the grass and the use of the reaper. The trees may be replaced every 14 or 15 years without injuring the grassland, by planting young trees 5 or 6 years old in the clear spaces 7 years before felling the old ones.

Anticipating the objection of insufficiency of sunlight on a piece of grass land planted with trees, it is stated that though this objection may be true for a wet climate it is not true for a dry climate, where excessive sunshine results rather in burning the grass than promoting the formation of chlorophyll.

Finally, stress is laid on the importance of the potassic and phosphatic manure formed by the large quantities of dead leaves which a forest 17 to 22 years old is capable of yielding the elements of which are taken from the subsoil.

Although these observations do not constitute really strict scientific experiments, they nevertheless enabled the writer to conclude with certainty that grasslands planted with trees or wooded meadows will on the average yield more hay than grassland without trees ; furthermore it supplies timber. It is, however, necessary, to repeat the experiments with cultivation of the alder tree in regular lines to the number of 184 to 216 trees per acre of grassland, doing the same with the birch and the oak, in order to ascertain definitively whether the combination is desirable.

976 – **Moisture Content and Shrinkage of Forage and the Relation of these Factors to the Accuracy of Experimental Data.** — V ONALL H. N. and MC KEE ROLAND, in *United States Department of Agriculture*, Bulletin No. 353, 37 pp. Washington, D.C., March 13, 1916.

The variation in moisture content in field-cured forage often gives rise to errors greater in amount than the differences in yield between improved varieties or different methods of culture. A study of the use of samples in correcting forage yields indicates the following results :

1) Air-dried samples are a little less accurate than oven-dried samples, but the difference is so small that the air drying of samples can be relied upon for all practical purposes on correcting forage yields.

2) Much greater extremes are found in the samples of field-cured

material than in the samples of green material, indicating that duplication of samples is more important in the former than in the latter.

3) Corrections by means of samples can be accurately made from either green or field-cured material, provided care is used in sampling.

4) Considering accuracy of results, facility of handling, and ease in figuring percentages, 5-pound samples of field-cured material and 10-pound samples of green material are recommended as the most desirable sizes for practical use

5) Samples need not be duplicated more than three times.

6) The percentage of moisture in the different crops at that period of growth when they are ordinarily harvested for forage was as follows : Alfalfa at Chico, Cal., 75 to 78 per cent., average 76.9 per cent; Alfalfa at Arlington Farm, Va., 74 to 76.5 per cent., average, 75.2 per cent.; Tall oat-grass and orchard-grass mixture at Arlington Farm, Va., 71 to 73 per cent., average, 72 per cent.; Timothy at New London, Ohio, when in full bloom, average, 67.2 per cent. Sorghum at Amarillo, Tex., 70 to 63 per cent., average, 71.2 per cent. These percentages are probably near the average for each crop, but the fact that McKEE found 75.8 per cent. and FARREL an estimated 79.5 per cent of moisture in alfalfa indicates that it will be impossible to establish any arbitrary percentage of moisture in the green plant as a basis for correcting forage yields.

7) The average amount of moisture in field-cured material was as follows : Alfalfa 2.3 per cent.; timothy, 20.3 per cent. ; tall oat-grass and orchard-grass mixture, 29 per cent.; sorghum, 43.2 per cent. The moisture content of field-cured material varies so widely that it cannot be foretold with accuracy.

The use of the sample method in correcting forage yields would greatly assist in standardizing agronomic data and do much to promote greater accuracy in field tests.

The system of correcting yield data by the use of air-dried samples is of most value in succulent crops like sorghum and Sudan-grass and is of least value in fine-stemmed plants like millet, which cure quickly and rather completely.

The relation of the moisture content to the stage of development in the plants was studied in alfalfa, timothy, and sorghum. The results were as follows:

1) Alfalfa at Chico, Cal. : Very young (12 inches high), 78.9 per cent.; one-tenth in bloom, 77.1 per cent.; full bloom, 74.6 per cent.; past full bloom, 73.4 per cent.

2) Sorghum at Amarillo, Tex.; Very young, 90.6 per cent. ; shooting for heads 87.1 per cent.; beginning to head, 84.8 per cent. ; full bloom, 80.4 per cent.; seed ripe, 75.3 per cent.

3) Sorghum at Hays, Kans., varied from 89.2 per cent. when very young to 73.2 per cent when seed was ripe, showing practically the same gradations as at Amarillo, Tex.

4) Timothy at New London, Ohio : Very young (10 to 12 inches high) 77.5 per cent.; just heading, 76.6 per cent.; early bloom, 71.4 per cent.;

full bloom, 67.2 per cent.; leaves fading, 58.6 per cent.; seed mature, 51.2 per cent.

5) The excessive percentage of moisture in young sorghum explains the very chaffy character of sorghum hay when the crop is cut too soon, and the 90 per cent loss in weight is an additional reason why sorghum should be fairly mature before it is harvested.

6) The moisture content of any crop at a given stage of maturity is not constant, but may vary with the conditions under which the crop is grown.

A study of the rate of loss of moisture in forage during the early stages of curing shows the following results :

| Crop and location | Moisture after: | | | | |
|---|---|---|---|---|---|
| | ½ hour | 1 hour | 2 hours | 3 hours | 4 hours |
| | per cent. | per cent. | per cent. | per cent. | per cent. |
| Alfalfa at Chico | — | 17 | 35 | — | 69 |
| Alfalfa at Arlington Farm | 6 | 14 | 23 | 28 | 32 |
| Tall Oat grass and orchard grass at Arlington Farm | 5 | 12 | 24 | 30 | 34 |
| Timothy at New London | 6 | 10 | 18 | 25 | 30 |
| Sorghum at Hays | 2 | 5 | 9 | 12 | 13 |

The approximate losses in the different crops were.

1) The rate of loss of moisture after cutting differs in different varieties of the same crop, as well as in different crops.

2) Although the Arabian alfalfa loses moisture faster than the Peruvian or ordinary alfalfa in the first one or two hours after cutting, still the total percentage of moisture is about the same for the three varieties.

3) A high percentage of leaf surface in alfalfa varieties is correlated with a rapid loss of moisture immediately after cutting, but it does not indicate a high moisture content.

Studies of the variation in the moisture content of growing alfalfa during a single day at Chico, Cal., show an average of 1 per cent. more moisture in the alfalfa at 8 o'clock a. m. than at 3 o'clock p. m.

Studies of the shrinkage in hay after storing and variation in moisture content due to changes in atmospheric humidity made with baled oat hay at Chico, Cal., and loose timothy hay at New London, Ohio, indicate results as follows :

1) At Chico, Cal., where the atmospheric humidity changes radically from the dry summers to the wet winters, baled oat hay showed a shrinkage in 1914 of 9.1 per cent. between June 1 and August 31, and a gain in weight from August 31, 1914, to February 25, 1915, of 5. 9 per cent. of the original weight.

2) The results at Chico, Cal., indicate that even baled hay responds noticeably to changes in atmospheric humidity, and that hay dealers are justified in taking into account the shrinkage of their hay when fixing prices.

3) The results secured at New London, Ohio, with loose timothy indicate a shrinkage of 8.6 per cent. in one lot and 15.6 per cent in another lot, when the hay was stored in a barn for about three months. The effect of a week of rainy weather was indicated by an increase of weight in the loose hay.

977 – **Investigations into Factors affecting the Handling of Wheat Hay, including a Study of its Digestibility.** — PERKINS ARTHUR I., PHILLIPS J. H., SPAFFORD W. I. and MAY W. S., in *Department of Agriculture of South Australia, Bulletin N° 82*, pp. 1-38, 33 tables + 3 fig. Adelaide, 1914.

From the investigations, which were conducted during the years 1911-1913, the writers have drawn the following general conclusions :

The yield of a crop of wheat cut down for hay will vary considerably according to the stage of development to which the crop has attained. The combined results of the two seasons' experiments show that the average increase in yield above that of a crop cut in the full bloom stage to be.

| | | | | | | |
|---|---|---|---|---|---|---|
| 20.31 | per cent. | in | the case of | hay cut | 6 | days after full bloom |
| 24.02 | » | » | » | | 13 | » » |
| 36.04 | » | » | » | | 21 | » » |
| 32.62 | » | » | » | | 28 | » » |
| 21.90 | » | » | » | | 35 | » » |
| 14.24 | » | » | » | | 42* | » » |

It follows, therefore, that maximum yields will be secured from cuts taken about three weeks after full bloom, at a time when the grain is just about to leave the milky stage. In this connection it should be recollected that these three weeks have reference to an early wheat grown under conditions of climate such that there elapses a period of six weeks between full bloom and the ripeness of the grain. In a general way it is perhaps better to state that maximum hay yields may be expected from cuts taken when the grain is about to leave the milky stage and enter upon the dough stage. In the three weeks that follow full bloom time, total increase in hay yield is distributed between ears on the one hand, and culms, and flag on the other, but in uneven proportion, the ears increasing in weight at a far more accelerated ratio than the culms and flag. The following figures will serve to indicate the nature of the increases gained respectively by ears on the one hand, and by culms and flag on the other, over and above their original weight at full bloom.

| | Ears. | Culms & Flag. |
|---|---|---|
| At full bloom time . . . . . | 100.00 | 100.00 |
| Six days after . . . . . | 137.77 | 118.28 |
| Thirteen days after . . . . . | 153.10 | 119.98 |
| Twenty-one days after, . . . . . | 246.75 | 120.48 |
| Twenty-eight days after . . . . . | 321.05 | 106.70 |
| Thirty-five days after . . . . . | 337.00 | 92.54 |
| Forty-two days after (grain ripe). . . | 340.40 | 83.33 |

* *Grain ripe.*

Therefore, when the grain begins to leave the milky stage there is not only a great disproportion between the relative weights of ears on the one hand, and culms and flag on the other, but relatively to the period of full bloom, a loss of weight in the latter, which although at first compensated for by a corresponding increase in the weight of the ears, becomes in the end an actual loss of what might have been good feeding material had the crop been cut earlier. In other words, hay cut after the milky stage of the grain tends more and more to become ill balanced hay, in which the culms and flag rapidly lose their feeding value; whilst if the hay is not cut at least a fortnight earlier than the ripening of the grain there arises to the grower an actual loss of hay.

In the matter of chemical composition the chief differences between hay cut at full bloom, and later cuts are as follows : — 1) Progressive decrease in the percentage of mineral matter and corresponding increase in that of organic matter characterises the gradual ripening off of the crop. 2) The percentage of proteins shows a tendency to rise during the first three weeks ; thereafter it steadily declines to the ripeness of the grain. 3) The percentage of fat appears to remain more or less stationary throughout the whole period. 4) The percentage of carbohydrates rises regularly and steadily in the ears thoughout the six weeks. It is balanced by a corresponding regular decrease in culms and flag. 5) Conversely, whilst the percentage of fibre steadily rises in culms and flag, it equally steadily declines in the ears.

A heavy loss of dry matter was noted in the last two or three weeks of the development of the wheat crop, a loss which attained to 22.9 per cent of the maximum cut in 1911, and 6.41 per cent, of the maximum cut in 1912. This loss, no doubt, must be attributed chiefly to the fall of the exhausted flag, and to a less degree to occasional shaking out of grain and other accidental causes ; to the weakening or suspension of the assimilation function ; and to the occasional leaching action of rain on a dry, porous tissue. In each year, however, we found that the proportional loss of mineral matter was considerably greater than that of organic matter, and we infer therefrom that as maturity advances there must be some sort of migration of the mineral matter towards the root system.

The loss of weight on drying of a wheat hay crop becomes gradually less and less as the ripening of the grain is approached. It is represented by close on three-quarters of the green weight of the crop in the full bloom stage, and by less than one-quarter of the green weight when the grain is ripe.

The percentage of moisture retained by wheat hay varies slightly with the conditions under which the hay was dried. Generally speaking, however, early-cut hay retains slightly more moisture than late-cut hay. In round figures, 10 per cent. represents the average moisture content of South Australian wheaten hay.

When a crop of hay is left to dry in a field, the loss of weight observed is not exclusively the result of the evaporation of water. Intimate chemical

reactions set up in the drying cells of the plants, the ultimate result of which is the destruction of more or less organic matter.

For wheaten hay, losses in this direction may attain to slightly over 1 ½ per cent. of the original green weight, and they are connected chiefly with the breaking down of carbohydrates.

Direct digestion experiments show that hay cut at full bloom is more highly digestible than any hay cut at later periods, and that in general the digestibility of wheaten hay decreases by regular steps as the period of complete ripeness is approached. In this connection there is a difference of over 12 per cent. between the digestibility of hay cut at full bloom and that of hay cut a week before the ripening of the grain. This superior digestibility of wheaten hay cut at full bloom holds good all long the line, with the exception, perhaps, of the doubtful case of the mineral matter. The regular decline in the digestibility of hays cut at later periods is most marked in the case of proteins and fibre. Carbohydrates are, on the whole, rather erratic in their behaviour, and perhaps on the whole they may be considered more or less stationary in their direct digestibility. The albumenoid ratio (a ratio found to exist in any foodstuff between the digestible proteins on the one hand, and the balance of the digestible non-nitrogenous organic matter on the other) is narrower and more favourable in character in the earlier cut hays than in those in more advanced stages of development. This arises from the more highly digestible condition of the proteins in the less mature cuts of hay, and the overwhelming preponderance of carbohydrates in the later cuts.

It appears that there is nothing to be gained and much to be lost, in deferring the cutting of wheaten hay until the grain begins to enter upon the dough stage. It involves, as a rule, both a reduction in total yields of hay and a reduction in quality represented by a reduced digestibility and a wider albumenoid ratio. Assuming that hay-cutting operations can be completed within a week to 10 days, these operations should be put in hand not later than a fortnight after full bloom.

These experiments amply confirm the value of the usual commercial standard by which hay is judged, viz. colour. It may be taken for granted that any hay that is not of good bright green colour is of inferior quality for feeding purposes, although it might make excellent litter.

978 – ***Paspalum* spp., Forage Plant in Argentina.** — *Gaceta Rural*, IXth Year, No. 107, pp. 685-689. Buenos Aires, June 1916.

The genus *Paspalum* of the family of Gramineae comprises more than 300 species scattered throughout the temperate, sub-tropical and tropical regions of the entire world, one half being in America (100 in Brazil and about 40 common to Brazil, Argentina and Uruguay). In Argentina, from the province of Jujuy to that of Buenos-Aires, several of the principal species of *Paspalum* occur fairly widely, comprising those regarded as the softest and best forage plants, for instance : *P. dilatatum* Poir., *P. notatum* Flügge, *P. plicatulum* Kuth (Mich.), *P. uruguayense* Arech., *P. pumilum* Nees. All these species form excellent pasturage, particularly *P. dilatatum sacchariferum* ("granilla melosa" or "pasto miel"), *P. notatum* and

*P. plicatulum*, which is peculiar to sandy soils. There are also the following marsh species: *P. Larrañagai* Arech., *P. multiflorum* Doell., *P. fasciculatum* Willd., *P. ferrugineum* Trin., which may serve for pasturage during times of drought; finally, *P. scoparium* Flügge and *P. barbatum* Nees, thrive on the patches of moist soil which occur on stony surfaces.

*Paspalum* grasses are generally sown in autumn or spring with other forage plants, preferably with clover or lucerne in the proportion of 5 to 7 lbs per acre, after giving a good dressing to the soil. It is best to feed them green to the livestock before complete flowering. For this purpose they are cut at that time, or fed to cattle off the land at an early moment, after which a second crop is obtained. *Paspalum* may be sown alone, in order to improve existing grasslands, or for seed production. In the latter case sowing is at the rate of 26 $^3/_4$ to 35 $^3/_4$ lbs per acre, which yields a crop of 357 to 535 lbs of seed. The seeds are also cropped from plants growing wild on stubble.

The analytic data contained in the appended Table are interesting, as they indicate the nutritive value of some of the principal species of *Paspalum*.

*Chemical Composition of some species of Paspalum and other Forage Plants.*

| Species | Origin | Ash | Total nitrogen | Crude protein | Albuminoids | Fat | Crude fibre | Carbohydrates |
|---|---|---|---|---|---|---|---|---|
| *Paspalum dilatatum.* | Lomas de Zamora . . | 12.45 % | 1.83 % | 11.17 % | — | 2.20 % | 31.21 % | 41.91 % |
| » » | Jujuy . . . . . | 11.91 | 1.47 | 9.23 | 6.88 % | 1.16 | 27.39 | 50.25 |
| *P. notatum* . . . . . | Lincoln (Buenos-Air.) | 12.45 | 2.09 | 13.06 | 9.32 | 2.47 | 24.15 | 47.50 |
| » » . . . . . | Santa Fé . . . . . | 9.29 | 2.09 | 13.06 | 9.32 | 2.58 | 31.35 | 43.68 |
| » » . . . . . | Entre Rios . . . . . | 10.58 | 1.10 | 6.87 | 5.98 | 0.96 | 37.10 | 44.50 |
| *P. Larrañagai* . . . . | San Luis . . . . . | 12.40 | 1.52 | 9.46 | 6.84 | 0.94 | 37.43 | 39.77 |
| *P. pumilum.* . . . . | Entre Rios . . . . . | 9.06 | 1.22 | 7.65 | 6.79 | 1.30 | 27.12 | 44.79 |
| *Lolium perenne* L. . | Buenos-Aires . . . . | 10.18 | 1.85 | 11.56 | 6.56 | 2.27 | 33.48 | 42.51 |
| » » | Santa Fé . . . . . | 11.50 | 2.10 | 13.12 | 7.93 | 2.10 | 31.57 | 41.71 |
| *Lolium brasilianum* Nees . . . . . | 6 specimens. . . . . | 11.69 | 2.11 | 13.18 | 8.53 * | 2.83 | 25.44 | 46.89 |
| *Bromus unioloides* H. Bet K. . . . . | 16 specimens . . . . | 11.76 | 2.57 | 15.96 | 10.26 ** | 2.83 | 29.50 | 39.91 |

* Average of 3 analyses. — ** Average of 6 analyses.

Calculating the nutritive ratios for 3 typical specimens, we have:

| | | |
|---|---|---|
| *Paspalum dilatatum* | (Lomas Zamora) . . . . . | 1 : 6.1 |
| *Lolium perenne* | (Buenos-Aires) . . . . . | 1 : 7.3 |
| *Lolium perenne* | (Santa Fé) . . . . . | 1 : 6.1 |

that is to say, on comparing with Perennial rye grass (*Lolium perenne*) which grows in the same parts, *Paspalum dilatatum* is not inferior in value from the point of view of richness in useful elements and mutual proportions of the latter. If this fact is taken into account, and also the abundance and good quality of the forage supplied during the entire year and the preference cattle show for it, one is forced to the conclusion that it is at least equal to English rye grass which has been imported into the country.

The same may be said of other wild forage plants occurring widely in Argentina, which might very well and at very small cost take the place of the numerous exotic species which Argentine breeders are endeavouring to introduce into the country at heavy expense.

979 - **Natal Grass (*Tricholaena rosea*), a Forage Plant for Hot Countries.** — Tracy D. C., in *U. S. Department of Agriculture, Farmer's Bulletin* 726, 16 pp., 4 fig., Washington, M, S. June 8, 1916.

*Tricholaena rosea*, called " Natal Grass " in the United States, is a native plant of South Africa, but long acclimatised in Florida. For some years past its cultivation in the sandy soils of that State has increased, and has also spread along the coast of the Gulf of Mexico as far as South Texas. In the United States this forage plant can only be cultivated right in the south. It is the most valuable forage plant hitherto found for the sandy soils of Florida, and will no doubt prove equally valuable in Southern Texas and further west in Arizona, as also in California.

*Tricholaena rosea* is a perennial, but does not survive the winter everywhere when the temperature falls much below 0° C. Heavy frosts destroy the fallen seeds, rendering natural propagation of the plant impossible. In Florida it is usually grown as an annual. The soils most suited to it are well-drained sandy soils. In compact soils it does not appear to spread itself well, It is suitable as a summer crop following on winter crops such as oats or kitchen garden plants. When a sandy soil has been sown with *Tricholaena rosea* it is not necessary to re-sow if the land cultivated in autumn has produced a winter crop and has been cultivated or harrowed again in the spring. If the soil on which this forage plant is grown is not used to produce a winter crop and is not cultivated, it will furnish an early spring crop and a large number of cuts in the course of the year. The total hay crop, however, will be about equal to that obtainable by growing a winter crop. The average unit production is 40 to 56 cwt. of hay per acre or about 13.5 cwt of hay per acre per crop. In good years, crops twice as great as these are obtained.

*Tricholaena rosea* is not adapted for forming a pasture, and ranks poorly as a grazing grass. Its hay is excellent ; it dries easily, is highly nutritive, looks good and is much liked by the animals. Its composition is as indicated in the appended Table, as compared with the average composition of Timothy (*Phleum*) resulting from analyses of 272 samples.

*Chemical composition (relatively to dry matter) of the hay of Tricholaena rosea and Phleum pratense.*

| | *T. rosea.* | *P. pratense* |
|---|---|---|
| Cellulose | 40.72 % | 32.86 % |
| Ash | 5.56 | 5.82 |
| Protein | 8.25 | 7.87 |
| Nitrogenous extract | 43.47 | 50.40 |
| Fats (ether extract) | 1.99 | 3.05 |

When the seeds crop is looked after and carefully handled, its quality is excellent in Florida. For proper keeping of the seed it is essential to dry it rapidly and completely.

*T. rosea* exhibits numerous and very divergent varieties: the United States Department of Agriculture is at present carrying out a field trial with a view to producing standard improved types. Some varieties were also recently introduced into Brazil.

980 – **Experimental Studies in Italy, for determining the Cultivation Value of Two Wild Lucernes.** — Josa G., in *L'Italia agricola*, 53rd Year, No. 6, pp. 250-253, 5 fig. Piacenza, June 15, 1916.

Scythe lucerne (*Medicago sativa* var. *falcata*) and variable lucerne (*M. sativa* var. *varia*) have repeatedly been pointed out by ancient and modern Italian agriculturists as being likely plants for forming artificial grasslands on poor, dry, barren soils, especially in the Southern provinces. Up to the present, however, no cultivation trials had been carried out. The latter have now been undertaken by the Office of Travelling Agricultural Lecturers at Campobasso with seeds originating partly from the Abruzzi and partly from the province of Campobasso.

In the first year of cultivation (1911), there were no noteworthy weather events ; 1912 and 1913 were exceptionally dry years ; the two following years were very rainy. Growth was from the outset poor and tardy in the case of *Medicago sativa* var. *falcata*, mediocre for variable lucerne and luxuriant for the *M. sativa* cultivated as a standard of comparison. These differences were maintained during the entire period of the experiment and were confirmed by the crop. The following are the conclusions :

1) Scythe lucerne possesses very little cultivation value and both for this reason and from other considerations, such as the difficulty of getting in the crop and the coarse quality of the forage, it can only be used in mixtures intended for the formations of permanent grasslands ;

2) Variable lucerne is more promising, and if it were selected and improved by cultivation it might perhaps replace *M. sativa* in all those cases, though they are few, for which the latter is unsuited;

3) Wherever it is possible to cultivate *M. sativa* even with mediocre results, the latter always exceeds what may be anticipated from the wild lucernes.

981 - ***Medicago orbicularis*: Attempts at Introduction into the United States.** — McKee Roland, in *U. S. Department of Agriculture, Farmer's Bulletin*, 730, 9 pp., 3 fig. Washington, D. C., June 2, 1916.

*Medicago orbicularis*, indigenous to the Mediterranean region, was introduced into the United States in 1899 by the Foreign Seed and Plant Introduction Office of the Department of Agriculture. In the following years, several other small lots of seeds of this species were introduced from the same region, but practically all the experimental work carried out was done with seeds from a sample which arrived from Algeria in 1902.

*Medicago orbicularis* has been tested on a larger scale in California, where it proved to be peculiarly well adapted. In the Southern States of the Union it was not sufficiently dried to allow of determining its value definitely. The work accomplished, however, already indicates that it is perhaps possible to use it with success in all those parts which enjoy a very mild climate, and where *Medicago arabica* is at present grown.

In order to thrive, *Medicago orbicularis* requires a temperate climate, the winter temperature of which does not go below — 10° C. It is not exacting as regards soil and humidity, and thrives under very diverse conditions. As a pasture plant it is especially valuable in the most temperate districts of the south-west of the United States, where it is preferable to *M. hispida denticulata* and *M. arabica*. It is easy to lay down land to pasture with *M. orbicularis* as it requires nothing beyond sowing. If, however, the soil does not already contain the bacteria giving rise to the formation of leguminous nodules, they must be inoculated into it. This inoculation is not necessary in those soils where *Medicago arabica* or *M. sativa* have already been grown. *M. orbicularis* gives good hay, but it is difficult to mow owing to its drooping habit. Usually it gives good seed crops, but the drying and threshing of the hay are rendered difficult owing to the fact that the seeds fall readily. In trials carried out at Chico, California, from 1908 to 1911, *M. orbicularis* gave as the average of this four-year period 8.4 cwt. per acre of husked seeds. *M. arabica* grown as a standard of comparison, gave during the three-year period 1908-1910 an average of 3.1 cwt. per acre.

The Author demonstrated by experiment that husked seed kept in ordinary stores had their germination capacity reduced by about one half after 3 or 4 years ; after 7 years it was reduced to ⅓ of its value. On the other hand the one year old seeds possess a good germination capacity (in 1911 it was 91 % with 4 % of hard seeds).

As a green manure, *M. orbicularis* possesses practically the same value as *M. arabica* and *M. hispida denticulata*.

982 - **The Green Pea as a Forage Plant in North America.** — Vinall H. N., in *United States Department of Agriculture, Farmer's Bulletin*, No. 690, 24 pp., 16 fig. Washington, D. C., October 8, 1915.

The green pea (*Pisum sativum*) is cultivated widely in North America as a forage plant and is then called " field pea " or " Canada field pea ". The cultivation of the green pea is of very ancient date, but up till latterly it was intended exclusively for human food. It is now widely cultivated in Canada as a forage plant, as well as in the States of the North American

Union, and, further south, in the high regions of the Rocky Mountains. It deserves to be more extensively grown in the Southern States of the Union.

To enable the forage green pea to thrive, there must be a temperate season coinciding with its period of growth. Great heat is much more injurious than frost, which is only disastrous if the plant has begun to form its pods. The best crops are obtained on clayey-sandy soils. The best varieties are : among the early ones, " French June "; among the mid-season ones, " Golden Vine " ; and among the late varieties, " Canadian Beauty " and " Blue Prussian ". Among new varieties, " Carleton " and " Bangalia " are preferred in the North-West States of the Union. In the Northern States, sowing must be carried out in spring as early as possible, that is, as soon as the soil can be worked. In the Southern States, sowing must take place in the autumn or at the end of winter. In wet parts, from 89 to 210 lb. of seed per acre is required, and in dry regions 60 to 180 lb per acre suffice. Sowing in rows is preferable. For hay production, it is desirable not to mow until the pod is well formed. For seed production, cropping must be delayed until the latest pods have begun to turn yellow. Mowing and haymaking may be carried out by ordinary machines with special devices fitted on them (described and explained by the writer) to prevent the teeth of the mower getting choked up, to lift the stalks and enable the cutting-bar to pass beneath, for binding, etc. Threshing may be carried out by means of an ordinary grain separator from which the majority of the concave teeth have been removed. The speed of the drum is thus reduced.

In San Luis Valley (Colorado) it has been found that the green pea forms good pasture for pigs and sheep. This forage plant deserves to be tried in other districts where grown, particularly those lying near mountain ranges.

When the green pea is grown for forage it is best mixed with oats or rye.

The green pea seed has been successfully used as a concentrate in rations for the production of meat or milk in cattle, sheep, pigs and dairy cows. The waste from green pea canning factories is sometimes put into silos and good results obtained, particularly with dairy cows.

In the citrus plantations of Southern California, the green pea has furnished a good green manure.

983 - **Cytisus as Forage** (1). — Perez Georges V., in *Bulletin de la Société Nationale d'Acclimatation de France*, 63rd Year, No. 6, pp. 217-220. Paris, June 1916.

The farmers of the island of Palma in the Canaries, use certain species of *Cytisus* as forage, namely " Tagasaste " (*Cytisus proliferus*, var. *palmensis* Christ), " Gacia " (*Cytisus maderensis* Masf. = *Teline stenopetala* Webb and Berthelot) and also " Herdanera " or " Gacia blanca " (*Cytisus pallidus* Sprague = *Genista splendens* W. and B.).

The writer protests against those prejudices which maintain that neither horses nor cattle will touch these plants, that the seeds of the latter will not grow, and that all forms of *Cytisus* are poisonous like laburnum.

(1) See *B.* June 1916, No. 640. (*Ed.*)

Instead of allowing the Tagasaste to grow into a tree, it must be cut two or three times per year to a height not exceeding a yard from the ground, in order that its tender branches may be more abundant. As with many other forages, animals must become accustomed to it, but once the taste has been acquired they continue very fond of it. Chopped and mixed with dried straw it is a perfect food comparable with lucerne. Tagasaste grows in mountainous and stony soils from which the plough is precluded, and resists drought admirably, enriching the soil by its roots which fix atmospheric nitrogen.

In the opinion of the writer it is highly desirable that these plants should be more extensively grown as forage in the Mediterranean basin, particularly in regions where the rainfall is scattered over wide intervals or where the summer is very dry, and consequently livestock breeding is very difficult.

984 – **Comparative Experiments on the Growth of some Varieties of Carrot at the Scientific Agricultural Station of Flahult, Sweden.** — Von Feilitzen Hjalmar, in *Svenska Mosskulturföreningen Tidskrift*, Year XXX, No. 2, pp. 128-129. Jönköping, 1916.

Experiments in sandy soils with the following varieties, which were lifted from the 10th to the 13th October.

| Varieties | lbs per acre of roots | Weight per Imperial bushel in lbs. | Average weight of one root in lbs | Tops in tons | Dry matter | | Relative yield | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | % | lbs per acre | Roots | | | | | Dry matter per acre | | | | |
| | | | | | | | 1914 | 1913 | 1912 | 1911 | 1910 | 1914 | 1913 | 1912 | 1911 | 1910 |
| Gul jätte (Champion) | 35 060 | 44.8 | .6 094 | 87.6 | 11.75 | 4 124 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| » » (Weibull) | 33 901 | 44.8 | .6 864 | 93,9 | 12.18 | 4 124 | 96 | 98 | 102 | 90 | 82 | 100 | 102 | 107 | 88 | 96 |
| Extra hvit jätte » | 32 920 | 43.2 | .7 106 | 121.9 | 11.25 | 3 704 | 94 | 104 | 99 | — | 92 | 90 | 116 | 96 | — | 96 |
| Supra hvit jätte » | 32 385 | 43.2 | .6 666 | 123.5 | 11.68 | 3 778 | 92 | 100 | 77 | 77 | 96 | 92 | 101 | 85 | 87 | 107 |
| Röd mellanmorot. . | 26 765 | 44.8 | .4 818 | 77.7 | 13.05 | 3 484 | 76 | 94 | 80 | 79 | — | 85 | 101 | 91 | 92 | — |

Gul jätte (yellow giant) in 1914 yielded the best results, both as regards the total weight and the quantity of dry matter; good results were likewise obtained with the two varieties of hvit jätte (white giant).

All the varieties kept very well under storage. The loss of dry matter from the autumn to the middle of March ranges from $^1/_8$ to $^1/_7$, and the percentage of roots spoiling is always very low.

985 – **Gum-yielding Plants of Brazil.** — Montandon Heitor, in *Chacaras e Quintaes*, VIIth Year, Vol. XIII, No. 6, pp. 417-421. San Paulo, June 15, 1916.

RUBBER, GUM AND RESIN PLANTS

Brazil possesses various indigenous plants which can supply a substitute for gum arabic, obtained, by incision, from several species of *Acacia*. Such are: 1) the different species known as " angico "; " angico " proper is *Enterolobium ellipticum* (*Pithecolobium gummiferum*), occurring very widely

in the States of San Paulo, Minas Geraes, Bahia and in the vicinity of Goyaz and Pernambuco; 2) " arvore da gomma " or " gomma lagrima " (*Vochisia gummifera*), is very common in the province of Rio de Janeiro; 3) the " vinheiro do campo " or " arvore do vinho " (*Vochisia thyrsoidea*) common in the State of Minas Geraes.

The best quality " gomma lagrima " (*i. e.* without impurities) is perfectly colourless and transparent; it dissolves completely in 11 parts of cold water and then furnishes a gum which is likewise colourless and transparent. Its specific gravity is 1.604 at 26.25° C. On analysis the following results were obtained :

*Composition of Brazil " Gomma lagrima ".*

| | | | |
|---|---|---|---|
| Water | 117.99 ‰ | Resinous substance | 0.43 ‰ |
| Arabine | 876.74 | Insoluble matter | 0.12 |
| Yellow bitter substance | 0.31 | Ash | 4.40 |

According to experiments conducted in 1884 by Prof. J. J. PIZARRO at the University of Rio de Janeiro, the gum of *Vochisia thyrsoidea* has an adhesive power 10 times greater than that of gum arabic. With respect to its medicinal properties, it is also fully able to bear comparison with the latter.

From 1900 onwards some consignments of Brazil gum were exported to Liverpool and to Germany, where they were greatly appreciated both on account of their good quality and their low prices.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL CROPS

986 – **Tobacco-Growing in Portugal.** — SONTO MAIOR J., in *Boletim da Associação central da Agricultura portuguesa*. Year XVIII, Vol. XVIII, No. 2, pp. 53-58, 1 fig. Lisbon, February 1916.

Tobacco-growing was introduced in Portugal in 1884, with the object of mitigating the crisis produced in the region of Douro by the phylloxera invasion. It was at first allowed by way of experiment for a period of 3 years, but subsequently the concession was constantly renewed. By decree of 1907 the State tobacco monopoly was granted by public sale to the " Companhia dos Tabacos " which was compelled to pay over to the State 65 % of its profits and to buy from the Douro growers the whole of their product up to 20 % of the total consumption. The growers deliver the tobacco in the form of strung leaves dried to 25 % of moisture. The Tobacco Company pays for it at its market value, which for ordinary unspoilt tobacco is mostly 18 centavos (4 ¼ *d.*) per lb. Furthermore by decree of the 2nd February 1891 a premium of 10 *centavos* (2 ½ *d.*) was granted for every pound of tobacco delivered in good condition. The average production per acre is 8 922 to 12 490 lb. of dry leaves. Home-grown Portuguese tobacco is used for manufacturing cheap cigars. In comparison with other European tobaccos it is of mediocre quality.

During the thirty years for which tobacco has been cultivated in Portugal the plant has hybridised naturally, has subsequently undergone selection and has become fixed in the type best adapted to the climatic and soil

conditions. Although the growers played no part in all these operations, Portuguese tobacco is to-day, according to the writer, in such a position that its intrinsic quality is incapable of further improvement; on the other hand, the methods of cultivation might be much improved.

VINE GROWING

987 - **Cultivation and Selection of *Vitis rotundifolia* and *V. Munsoniana* (Muscadine Grapes) in the United States.** — HUSMANN GEORGE C. and DEARING CHARLES, in *U. S. Department of Agriculture, Farmer's Bulletin* 709, 28 pp., 29 fig. Washington, D. C., April 1st, 1916.

The vines called " Muscadine " in the United States are native and thrive (under suitable conditions of soil and climate) throughout the seaboard plain in the South-east of the Union, from James River to Florida, as far as the Blue Ridge mountains, and from Florida along the coast of the Gulf up to Texas; towards the north along the Mississippi up to South-east Missouri and the river Tennessee. In this zone about 25 million acres at least (of which a large part at present is uncultivated) are perfectly adapted for the growing of these vines. For some time now the " Muscadine " vines have been more widely cultivated than all other stocks over a large part of this territory, but it is only during the last 10 years that their production has attained to any real commercial importance. Of the two species which bear the name of " Muscadine " the more important is *Vitis rotundifolia*. It comprises the most widely grown stocks (Scuppermong, Mish, James, Flowers, Thomas, and Eden), and is indigenous in the whole of the above mentioned zone. *V. munsoniana* is if anything one of its sub-tropical varieties, and is native to Florida, the coast zone, the Gulf of Mexico and perhaps to the region adjoining the south-eastern coast of Georgia. *V. rotundifolia* has small bunches made up of big grapes with big stones. *V. munsoniana* has comparatively large bunches with small grapes and small stones. Furthermore, it tends to produce continually, and in August it bears buds, flowers and fruits in all stages of development.

The " Muscadine " stocks are reproduced by seed or are multiplied by slips or layers. The last method is most in use. Grafting which does not give very good results, is rarely resorted to. The most commonly grown varieties have practically a sterile pollen, although their flowers are hermaphrodite. Cross pollenation with vines having exclusively male flowers is therefore necessary. Such is the case with 75 % of the wild vines. It has been clearly established that these vines are entomophilous. Formerly wild vines grew in sufficient number to guarantee annual cross-pollenation. At present the number is much less, therefore the vineyards have to be planted with them to the extent of one to 8 or 10 fertile vines. It would be highly desirable to place bee-hives in the middle of big vineyards. While, under natural conditions, from 7 to 10 % of the buds of " Muscadine " stocks produce grape bunches, if they are carefully pollenated the proportion producing them is from 20 to 30 %.

As the average production for 4 year old stocks from 1200 to 1430 lbs of grape per acre may be reckoned; for 5 year old stocks from 2410 to 3570 lbs per acre; for stocks in full bearing from 4550 to 7226 lbs.

About $^3/_5$ of Muscadine grape are used for wine-making, especially

the fruit of the varieties the grapes of which fall when ripe, and which are gathered by spreading cloths beneath the stocks, or shaking the latter, and afterwards separating the grapes from the impurities (leaves, branch débris, etc.), by means of a fan. These grapes fetch on the avrage from $^3/_4$ *d.* to 1 *d.* per lb. On the other hand, the varieties from which the ripe grapes do not drop are cropped by gathering the grapes; their fruits are sometimes eaten as table grapes and fetch a slightly higher price than those above referred to, but they cannot stand lengthy transport. Excellent jellies, jams and syrups, etc., are made with " Muscadine " grapes.

The United States Department of Agriculture is at present engaged in experimental selection of Muscadine stocks with the object of producing varieties possessing: 1) better adhesion of the grape to the bunch; 2) larger size of the bunch ; 3) a higher sugar content ; 4) less acidity ; 5) a better pulp ; 6) smaller and fewer stones ; 7) a finer skin ; 8) uniform ripening ; 9) self-fertilisation. A large number of excellent seed plants and several much esteemed varieties have already been obtained. A group of 49 nurseries has been established, where 50 % of the plants show perfect flowering and self-pollenation, and where there is not even a single sterile male plant. Hence the belief that the complete realisation of the objects in view is a question of time has become a conviction. Furthermore, a number of highly promising hybrids have been obtained between the Muscadine stocks and the American *Euvitis*, and between the Muscadines and the *Vinifera*.

The Muscadine stocks are remarkably exempt from diseases and insect pests. The most serious disease is " blackrot " (*Guignardia Bidwellii*) which, in unfavourable years, attacks the flower buds and the leaves, but to a far less serious extent than in the case of *Euvitis*. Control measures consist in spraying with Bordeaux mixture.

Among insect pests, mention must be made of the grapevine flea beetle (*Haltica chalybea*) and an unidentified coleopteron (snout beetle) ; the damage hitherto caused by them, however, is insignificant.

FORESTRY

988 - **Relations between Forest Valuation and Management.** — Frey P., in *Zeitschrift für Forst- und Jagdwesen*, No. 12, Berlin, 1915.

Adherents of the theory of the net produce of the soil base their calculations of forest value on the determination of " expectation values " as regards such forest stands as the forest is capable of producing. In drawing conclusions from their results they take as their basis the " expectation value of the soil " resulting from the yields stated in money which in theory a soil devoted to forest cultivation is capable of furnishing after deducting the expenses of cultivation. They classify as being theoretically most advantageous to the forest owner that method of working which allows of reckoning on the highest sum as the " expectation value of the soil ". Although they recommend that a low rate of interest be adopted, they leave it to the free discretion of the forest owner to choose the rate, which is the factor influencing in the greatest degree the result of the computations.

The great disadvantage presented by this method is that the most advantageous mode of working does not coincide with the maximum amount

found for the " expectation value of the soil ". As valuation of the forest and management should correspond in their results, the writer recommends the abandonment of the theory of " expectation values " in favour of another method of calculation.

On the method here advocated only the present exchange values (common values) of the plants have any influence on the result, and the method is termed " method of the exchange values ". It gives much more reliable results, although the values are only approximate and depend on the laws of supply and demand.

The value of the soil on which the stands grow does not in any way form a standard of guidance as regards the most judicious mode of working, and consequently cannot be taken into account in this question. The value of the initial material alone plays a decisive part in the installation of the forest management, because it is the fluctuations in this material which give rise to those in the annual growth of the stand. Tabulation of the annual increment (tables of return) is the best basis on which to decide as to the method of working to adopt. These results may serve as a reliable basis with a view to the management of the forest.

The science of forest management should furnish guidance as to the course to be pursued in determining the initial material, and the average annual growth. According to the writer, the determination of the value of the standing timber and growth should not be effected by measurement, it being sufficient to calculate these values by the aid of properly compiled tables. When the average figure representing the total annual growth of workable wood, and also of secondary material and underwood, has been determined by means of the tables of yield, and it has been ascertained that this total growth can be utilised uninterruptedly without diminution in the initial material, the task of practical management of the forest is solved. The writer already demonstrated in 1888 and 1889, by means of an example of average annual yield expressed in money, that the determination of this value is practicable. It need hardly be said that the same mathematical demonstration may be effected where yields by volume are in question instead of money yields.

The utilisation of the tables of yield by volume allows, by simple calculation, of determining the necessary bases for the management of the forest. First there are calculated the total annual yields of workable wood as well as secondary material and underwood then the material required for the durable working of these annual yields, and finally the economic age.

If the period of rotation to be selected is designated by $x$, and if $Zx$ denotes the total annual growth per acre of workable wood, secondary material and underwood corresponding to such period, and $Mx$ the normal material of workable forest and underwood per acre, the equation $Mx = \frac{Zx \times x}{2}$ is obtained. All the oldest plants in a class of management for which the period $x$ must be maintained, must be deemed workable in view of the fact that their felling yield exceeds the minimum amount ; all the youngest

stands, the felling yield of which remains below the minimum amount, must on the contrary be regarded as not yet workable. Consequently, all the youngest stands will be entered in account not at their ordinary felling yield, but in the form of a product obtained by multiplying the total annual growth of workable material by their respective ages.

If the forest owner expects from his forest not only as high and valuable as possible a yield of standing bulk, but also a maximum financial yield, it is sufficient if management, instead of being based on the tables for yield by volume, is based on tables of money return.

## LIVE STOCK AND BREEDING.

BREEDING

989 – **The Detection of the Prepotency of Sires.** — HOVER J. M., in *The Journal of Heredity*, Vol. VII, No. 4, pp. 173-178. Washington, D. C., April, 1916.

The superiority of a parent or a breed in determining the characters of its offspring is termed "*prepotency*". This character only occurs in very few animals of each breed, and was studied by the writer in the Guernsey cattle in the United States, making use of the herd-book instituted for this breed by the American Guernsey Cattle Club.

Sires having the power of producing improved offspring are generally detected by an examination of the progeny, sometimes a long time after the death or slaughter of the sires themselves.

In order to determine the character of improvement exhibited by a sire, the number of his progeny admitted to registration in the herd-book may be taken as a criterion. The writer rejects this method on various grounds, especially in the case of the American Guernsey breed, owing to the facility with which an animal may be registered, the conditions of admission not being sufficiently stringent (all that is required is the production of 360 lb of butter-fat for a full grown cow, while the average production is 312.771). He likewise rejects the method which consists in comparing the daughters of different sires with their respective dams and noting the amount of improvement. He therefore takes as the criterion of the prepotency of a bull the number of the latter's daughters which produce a very high yield of fat, or, in the case of the Guernsey breed, 600 lbs per year at the time of full growth, and he furthermore introduces the idea of the "equivalent of 600 pounds", that is to say of the young cow, which according to its present production, will probably yield 600 pounds at the age of 5.

In December 1915 there were only 32 bulls which had sired 3 or more daughters with a production equivalent to 600 pounds of fat. This number is very low, representing only 0.092 % of the males registered in the herd-book of the American Guernsey breed. The writer therefore concludes that prepotency is very rare, being found in only 1 per 1000 of the Guernsey breed of bulls.

The writer next studied the ancestry of these 32 bulls which clearly exhibited a prepotent character; he found that with the exception of 3 they all belonged to 7 families, which therefore clearly presented a prepotency.

Each family had sprung from an ancestor which had transmitted its prepotency to a number of its descendants. He further concludes that the character in question is probably increased by in-breeding, although some American prepotent sires are the result of crosses between members of different prepotent families.

990 - **A Sex-limited Colour in Ayrshire Cattle.** — WENTWORTH EDWARD N., in *Journal of Agricultural Research*, Vol. VI, No. 4, pp. 141-147. Washington, D. C., April 24, 1916.

In the Ayrshire breed the coat is generally red and white, nevertheless in the United States animals of black piebald colour have been observed from time to time (1). Up to the present day, no attention has been paid to the mode of transmission of this coat, because in America it was considered as being undesirable and it was sought to eliminate it by selection. It is difficult to ascertain whether the black is due to a true black pigment, or whether it is simply a very intense red. Under the microscope, typically black granules appear to be present, but no attempt has yet been made to obtain a chemical solution of the pigments.

The writer, for his studies, had recourse to the pedigree (ancestors and descendants) of the Ayrshire bull of the scientific Agricultural Station of Kansas, with white and very dark mahogany red coat (called above black piebald). 63 individuals were taken into account altogether. After classification and discussion of the results, the following conclusions are arrived at:

1) The black piebald colour is a simple allelomorph of the red piebald colour in Ayrshire cattle.

2) In the males, the black piebald character is dominant ; in the females the red piebald character is dominant.

3) Males heterozygous in respect to the two characters have black piebald coat, while heterozygous females have red piebald coat.

Appended is a bibliography of 4 works.

991 - **Encouragement of the Breeding of Small Livestock and Bee Keeping by the Prussian State Railway Administration.** — BADERMANN, in *Deutsche Landwirtschaftliche Tierzucht*, 20th Year, No. 20, pp. 159-160. Hanover, May 19, 1916.



In 1906 it was proposed in the Prussian Diet to place a sum at the disposal of the State Railway Administration for distribution to minor officials and workmen already possessing hives or desiring to obtain them. In 1907 the proposal was carried into effect and the Railway Administration was also recommended to make provision for bee-keeping when planting trees and hedges on slopes and to arouse the interest of workmen and employees in bee-keeping by means of lectures and the distribution of suitable publications. The Railway Administration was furthermore authorised to give financial and moral encouragement to the purchasing of lives, and it facilitated attendance to lectures and bee-keeping exhibitions by workmen and employees.

(1) See *B.* 1915, No. 1063. (*Ed.*)

Table I gives particulars of the encouragement granted during the period 1907 1910.

TABLE I.

| Years | Amount of grants | Number of workmen and employees who benefited by these grants | Number of workmen and employees who followed courses of lectures and attended agricultural exhibitions | Number of workmen and employees engaged in bee-keeping |
|---|---|---|---|---|
| | £ | | | |
| 1907 . . . . . | 653 | 165 | 208 | 2 343 |
| 1908 . . . . . | 552 | 165 | » | 2 409 |
| 1909 . . . . . | 602 | — | 199 | 2 511 |
| 1910 . . . . . | 637 | — | » | 3 002 |

In order to improve the economic condition of the workmen and minor officials, especially those residing in the country, in view of the success of the experiments previously carried out, the Railway Management was also advised to encourage small-livestock breeding (goats and rabbits) in addition to bee-keeping. With this object, in addition to the measures mentioned above for bee-keeping, the following were proposed : to get the workmen and officials to join the livestock-breeding associations ; to interest labour organisations in these questions ; to subsidise the construction of suitable pens and rabbit-hutches.

Table II furnishes indications as to the encouragement granted in this new period.

The total number of persons engaged in bee-keeping and raising the above livestock is therefore 87 902, a by no means contemptible figure from the point of view of the production of milk, meat and honey during the war. No data are available as to the number of goats and rabbits, or as to the quantity of animal products obtained. The number of hives was 26 846 at the end of 1914.

TABLE II.

| Years | Grants for the purchase of | | | Number of persons receiving grants for | | | Number of workmen who attended lectures | Number of workmen breeding | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | bees | goats | rabbits | bees | goats | rabbits | | bees | goats | rabbits |
| | £ | £ | £ | | | | | | | |
| 1911 . . . | — | £815 | | — | 432 | | 1 292 | 3 674 | 42 179 | |
| 1912 . . . | 10 31 | 12 34 | 13 07 | 500 | 488 | 1 500 | — | — | — | — |
| 1913 . . . | 14 28 | 17 53 | 12 54 | 565 | 628 | 1 809 | — | 4 960 | 30 654 | 35 350 |
| 1914 . . . | 10 86 | 16 29 | 15 80 | 505 | 1 225 | 2 093 | — | 5 367 | 31 879 | 50 656 |

The figures for the year 1915 are not yet known.

To sum up, the total subsidies allowed from 1907 to 1914 amount to £6834 for bee-keeping ; £5140 for goat breeding and £4172 for rabbit breeding.

992 – **The Adaptation of Different Breeds to the Livestock Industry in the United States.** — WENTWORTH E. N., in *The Field*, Vol. XXVI, No. 6, p. 501-503, 542, 544, 546. New York, June 1916.

The adaptation of a breed of livestock to different agricultural conditions depends inversely on its degree of specialisation with a view to a given purpose. The result of this is a restriction of adaptation which practically determines the distribution of the different breeds. Those breeds which are most perfectly specialised predominate in specific localities, while those which have least deviated from the original conditions of non-specialisation are the most widely distributed throughout the agricultural regions of the globe.

*Cattle.* — The Shorthorn breed has been the principal source for the improvement of beef cattle. Cattle intended for dairy production in New England and Longhorn cattle in Texas received their first impetus by the inheritance of the characters of this pioneer in cattle improvement. In the blue-grass region the descendants of the Durhams have found the best environment, and the Shorthorn breed has since then become and remained the principal breed in the corn belt and the one preferred by farmers.

In the West and South-West of the United States, the first impulse towards the replacement of livestock of mixed breed and Mexican livestock likewise arose through the introduction of the Shorthorn ; the development of the meat industry in Argentina is closely linked up with the spread of the Shorthorn; and so is that of Australasia, in the proportion of at least 60-80 %. The high degree of adaptation of this breed has resulted in its forming, so to speak, the vanguard which prepares the way for the introduction of other more highly specialised breeds. This is what took place in the corn belt, where the value of the lands requires the quickest possible growth and early maturity.

The Aberdeen-Angus, with its splendid body, its early maturity and economy in feeding, enabled a fresh margin of profit to be secured ; nevertheless, the Shorthorn still retains its popularity, as is proved by data showing distribution, which are largely in its favour. The Aberdeen-Angus furthermore proves that it possesses in the highest degree the quality of a show animal in competitions with a view to obtaining very high-class products at shows and exhibitions. At the last international exhibitions, ten live champions and fourteen killed champions belonging to this wonderful breed gave fresh its proof of its superiority.

In those belts where forage production is unlimited, but where there is little grain growing, the Hereford breed has gained the upper hand over the Shorthorn, and has been substituted for the latter in the prairies of the West.

In the pasturage belt of the North and the cold region of Alaska, the Galloway breed has demonstrated its great powers of resistance and its

superiority over all the other selected races in surmounting unfavourable environmental conditions.

Among other breeds, the Polled Durham and Polled Hereford proved their efficacy in the improvement of ordinary cattle by the rapidity with which shortening of the horn is produced by crossing ; the Red Poll breed has also asserted itself as a good dairy animal with good fattening qualities, as is proved by the carcasses of this breed shown at exhibitions, and it has thus established its right to exist as a dual-purpose breed. Other breeds like the Devon, have not yet received that final sanction of practice which enables them to be regarded definitively as excellent.

Naturally, the dairy breeds, in order to stand their ground, have had to compete with the Shorthorns and Devons imported by the first colonists ; consequently the progress of dairy breeds generally has, with the exception of some rivalry between the Holstein-Friesians and the Jerseys, been confined to the undertaking, almost in co-operative form, of the conquest of the lands occupied by the red, white and roan cattle. The very fact, however, of the varied distribution of the races establishes differences between them as regards their adaptation and intrinsic value, which differences are not always admitted by their partisans. The privileged position gained by the Holstein-Friesian breed in the belts surrounding big towns is a testimony to its great production of milk for sale, just as the fact of wide distribution of the Jersey breed in the South tends to prove its greater resistance to the hot climate. The persistance of many able farmers in maintaining the Jersey breed on certain model farms establishes the quality of its products and its ability for economical production under the most intensive working conditions.

The merits of the Ayrshire and Guernsey breeds are comparatively less popular in the United States. The Guernsey breed, in the belt where it is favoured, has already stood the test as a rival of the Holstein-Friesian, and also as a competitor with the Jersey in the capacity of a breed capable of economically yielding a product of superior quality. The Guernsey breed to a certain extent possesses the general characters of the Shorthorn breed for butcher's cattle, and no doubt it would have formed the intermediate link in specialisation if the demand for a highly specialised breed had not arisen too rapidly for the Guernsey to gain a footing. The Ayrshire breed, on the other hand, possessed the advantage of its nationality during the early periods of Canadian colonisation, when many Scottish colonists settled there, and had gained a footing in the rather cold regions of the New England hills for the production of milk in a somewhat greater quantity than that of the Jersey and Guernsey breeds, the quality being almost equal.

Finally, each breed possesses its clearly recognised advantages. The Holstein-Friesian, as a good producer of milk and fat, has gained noteworthy success in the hands of the ordinary farmer specialising in milk production. Its special ability to consume large quantities of bulky foods, which allows of a considerable reduction in the consumption of concentrates, and its qualifications for giving good results in rearing calves intended for meat

production, render it essentially the dairy cow for the farmer at the head of a non-specialised farm.

The qualities of the Jersey breed are well known. The characteristics are the richness of the milk in fat, economy of production and beauty of type, which render it the favorite breed for competitions and shows. Owing to this it was not long in becoming the favourite breed on big farms, and it has thoroughly stood its ground after a trial of three quarters of a century. At shows and at tests of fat yield it has maintained its position as first in rank among the dairy breeds, so that in the public mind the name of the Jersey breed is associated with the idea of every improvement in milk production.

The Ayrshire breed owes its favour to like qualities. Being the hardiest among the dairy breeds, and also exhibiting lines of great beauty, it has become the dominant breed on the Pacific Coast owing to the uniformity of its products. Its constant breeding true to type, as well as the quantity and quality of the milk throughout its offspring, form its principal merit. Probably it possesses in a latent form the necessary qualities for further specialisation, but hitherto this race has not been subjected as systematically as the others to comparative tests with a view to accurate determination and increase of its productive qualities.

The specific quality of the Guernsey breed as a market milk producer is shown by the fine yellow colour of the milk, this colour being highly appreciated by consumers. The breed, however, possesses other and far superior qualities. Its milk production, as compared with the Jersey breed, is also higher, and the fat content of the milk is likewise greater than for the Ayrshires and the Holstein-Friesians. It is gaining ground annually with a large number of milk producers, above all those in charge of non-specialised farms.

*Horses.* — As regards horses, events in the United States have been somewhat similar to what has occurred with cattle. The American trotter, after attempt to increase of speed over a century, continues to be selected outside the breeding of the American farm horse. To-day the original races only exist for the production of mares intended to be crossed with heavy draught stallions. The breeding of the American thoroughbred trotter is of importance henceforward to sporting circles, and that of the light draught horse has to-day disappeared from the most advanced agricultural regions, giving place to the heavy draught farm horse.

The Percheron was the first to introduce on a large scale the proportions of the heavy draught horse among American farm horses. It was particularly adapted for that task, owing to the comparative lightness of its skeleton, its vigorous blood, and its marked qualities for increase of weight. It occupied, in America at least, the same place in respect to horses as the Shorthorn breed did for cattle. Its principal merit consists in having given weight to its descendants and thus complied with the general demand of farmers.

A striking contrast with this development is afforded by the more specialised labouring horses, such as the Clydesdale, Shire and Belgian breeds. The Clydesdale breed was imported practically at the same time as the Per-

cheron, and has stood the test in all attempts at breeding specialised races, without however succeeding in imposing its type on the farm horse, because it is a type too specialised in the direction of the heavy draught horse, and the first breeders, who were unable to discern the requirements of intensive feeding in the foals of this breed, had some failures, because the Clydesdale was produced for a single purpose only, and it should either be a heavy draught horse or not exist. The Shire race also had similar failures at the outset.

Nevertheless, when breeders had mastered the breeding methods enabling the desired type to be secured with certainty, utilising the experience gained with the Percheron, they decided to repeat the trial with the Clydesdale, the Shire and the Belgian horses, with ultimate success. The Belgian horse was the last to breed out, and in fact has only done so during the last five years, when, from the point of view of export, it gained such importance as to play a part in horse-breeding in America, but its rapid spread in the corn belt and the enthusiasm with which it was received there render it clear that the only limit to its further spread lies in the number of available sires.

As regards the individual qualities of these breeds, the Shire undoubtedly possesses the maximum pulling energy per individual, while the Clydesdale is more perfect in its outlines and action, endowed with longer life and less subject to disease ; the Belgian offers a special resistance to continuous daily work, though it is not so active as its English rivals ; the Percheron finally is the best adapted for crossing with the American working horse.

*Pigs.* — An evolution similar to that undergone by cattle and horse breeding is also observable in pig breeding. The Berkshire played the part of the Shorthorn. In Canada and the Middle Atlantic States it is the pre-eminent meat producer. Along the Pacific coast and in South and Eastern America it represents almost exclusively the improved breed imported from the West. In New England it rivals the Chester White in popularity, while in the corn belt it is run close by the Poland China and the Duroc Jersey.

These last two breeds form the dominant element in the region which specialises in pig-breeding. The Poland China was not slow in establishing its claims owing to its early maturity, fattening qualities and possibility of profit on an economic basis. It had a close rival in the shape of the Duroc Jersey, which is superior to it in fertility, adaptation to pasturage and general hardiness. The two breeds have made progress partly owing to the absolute contrast between them, and tendencies to obtain the extreme forms of each type, which extreme forms are termed " hot bloods " and " cold bloods ". From the point of view of adaptation, the Chester White was able to spread to advantage in some regions of the United States, and the principal quality of the Hampshire breed as regards meat production may in the future secure this race a greater popularity. The Yorkshire and Tamworth breeds, which are good for bacon production, are more rarely met with, and the localities where they have adapted themselves are less frequent, their merit being nevertheless genuine and easily observed in

the districts of Ontario, Quebec and New York, as also in Michigan and Minnesota.

*Sheep.* — In sheep breeding, the Shropshire and Hampshire breeds are the most widely found, being appreciated both on small farms, ranches and extensive sheep pastures. The former breed is valuable for its fleece, the latter for its weight. The Oxford requires more abundant pasturage; the South Down is the classic meat producer; the spread of this latter breed is also due to its size and its splendid fattening powers; there are very few breeds which can dispute its supremacy as a show animal, or for the butcher. The Dorset breed has gained favour with some breeders, chiefly owing to its capacity to produce lambs during the winter period, and its good milk production.

The fine wool breeds, Rambouillet and Delaine Merinos, have had to give way to meat breeds in the agricultural region where land is dear; on the great prairies, however, they still form the basis of big flocks, owing to the value of their wool and their remarkable herding instinct. The Lincoln and Cotswold are still very much in demand for the purpose of crossing with the two above breeds, owing to their great size and to their precocity and abundant wool production. The Leicester and Cheviot breeds are limited to the northern climate and find particularly favourable conditions in Ontario.

The factors limiting the spread of the Cheviot breed are its size and its undeveloped herding instinct. Nevertheless, after the South Down, this race possesses the best type of carcass, but the possibilities of its extension through the region of the Apalache mountains, and the other mountainous parts have not been developed.

993 - **Horse Breeding in Minnesota.** — *The Breeder's Gazette*, Vol. LXIX, No. 25 p. 1294. Chicago, June 22, 1916. HORSES

A " Report of the Horse Breeding Industry in Minnesota " issued by the " Minnesota Stallion Registration Board ", University Farm, St. Paul, Minn., shows that 2056 purebred and 1896 grade stallions were licensed to stand in Minnesota this year. This is an increase of 54,7 per cent. of purebred stallions and a decrease of 14.3 per cent. of grades in the last 6 years. Of the 2056 licensed stallions, 1244 are Percherons, 326 Belgians, 126 French Draft, 93 Clydesdale, 52 Shires, 4 Suffolk, 142 Standardbreds, 23 Morgans, 21 German Coach, 11 French Coach, 5 Hackneys, 4 Shetlands and 2 American Saddlers. The stallion registration board tends to encourage horse development in the State in every possible way. Special horse breeders' meetings are held at various points in the State, judges are furnished for many local colt shows, speakers are sent to meetings of farmers' clubs and short courses, and farmers are assisted in the selection of good sires. Special attention is given to considering inquiries pertaining to the feeding, breeding and management of horses.

The stallion registration law is vigorously enforced by the board; the 25 cases prosecuted in 1915 for violation of the law were all decided in favour of the State, with fines of $ 25 to $ 100.

CATTLE

994 – **Statistical Data as to increased Weight and Food Consumption of the Jersey and Holstein-Friesian Breeds from irth to Bfirst Calving.** — HAYDEN C. C., in *Ohio Agricultural Experiment Station, Bulletin* 289, pp. 1-30. Wooster, Ohio, August 1916.

The Ohio Experimental Station has published the result of its researches into the daily increase of the Jersey and Holstein-Friesian breeds from birth to calving. The data were collected at the experimental farm, and comprise up to now : 69 series of individual daily observations up to one year, 51 series up to two years, and 37 series up to the first calving. In addition to the increase of weight, there was also noted day by day the quantity of food consumed and the cost of this food, as well as the total cost of rearing, allowing for the other expenses incurred.

We sum up in the following table the average data in reference hereto :

| Breed | Average weight at birth lbs. | Average weight at 1 year lbs. | Average weight at 2 years lbs. | Average weight at 1st calving (26-27 months) lbs. | Average daily increase in 1st year lbs. | Average daily increase in 2nd year lbs. |
|---|---|---|---|---|---|---|
| Jersey . . . . . | 56 | 472 | 758 | 780 | 1.1 | 0.8 |
| Holstein-Friesian. . . | 82 | 564 | 962 | 1 076 | 1.3 | 1.0 |

*Food consumption during the first year and costs of rearing.*

| Breed | Milk | | Cereals (grain) | Silage | Hay | Maize stalks | Pasturage | Cost of feeding | Other expenses | Total cost |
|---|---|---|---|---|---|---|---|---|---|---|
| | Full cream lbs. | Skim lbs. | lbs. | lbs. | lbs. | kg | days | | | |
| 40 Jersey . | 465 | 2 968 | 597 | 458 | 709 | 40 | 122 | $ 27.75 | $ 14.79 | $ 42.54 |
| 29 Holstein | 449 | 2 786 | 656 | 580 | 760 | 29 | 128 | $ 29.31 | $ 14.79 | $ 44.10 |

*Consumption of food during the second year and costs of rearing.*

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 19 Jersey . | | 87 | 785 | 2 426 | 1 038 | 254 | 159 | $ 27.12 | $ 8.89 | $ 36.01 |
| 22 Holstein | | 174 | 870 | 2 247 | 1 419 | 232 | 151 | $ 29.55 | $ 8.89 | $ 38.44 |

*Consumption of food and costs of rearing from birth to 1st calving (26-27 months).*

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 24 Jersey . | 469 | 3 005 | 1 349 | 2 870 | 1 805 | 291 | 272 | $ 54.51 | $ 23.68 | $ 78.19 |
| 13 Holstein | 445 | 2 835 | 1 517 | 2 903 | 2 215 | 243 | 272 | $ 58.12 | $ 23.68 | $ 81.80 |

An examination of the individual series discloses the fact, which is important for practical purposes, that calves born in autumn may be reared to the age of one year at a cost below that of calves born in the spring. The

reason is that when spring comes the former are already able to utilise pasturage to the full for the whole of its duration, while for those born in the spring the period of pasturage coincides largely with the suckling period, and the winter period with that of growth, during which the consumption of forage and concentrates reaches its maximum.

The quantity of food consumed corresponds to rations capable of providing the complete normal growth of each individual, and is such that it may be considered that any economy made in this respect would have impeded normal growth, and that an increase of the ration would probably have given rise to an increase of growth in the animal, but at such a cost that its adoption would not be justified.

995 – **Progress of the Holstein Breed in the United States.** — *The Breeder's Gazette*, Vol. LXIX, No. 24, p. 1257. Chicago, June 24, 1916.

The Annual Meeting of the Holstein-Friesian Association of America, which was held on the 7th June at Detroit, Mich., was attended by 2 683 out of the total number of 8 885 members of this association. During the last financial year there has been an addition of 1 260 life members.

The Herd-Book of the Holstein-Friesian Society of America already dates back 45 years and records the presence in the United States of more than 300 000 pure-blooded Holstein-Friesian animals distributed among 30 000 owners. A new census of them will be carried out during the next year.

During the last working year 72 665 animals were entered in the Herd-Book, and the registration of 68 766 transcriptions owing to change of ownership was made.

In the Advanced Registry there appears as tested during the last association year 12 882 cows producing an average of 408 lbs. of milk and 14.40 lbs of butter fat in 7 days, with a maximum of 35.53 lbs of fat for Ormsby Jane Segis Aggie, and of 1205.09 lbs. of fat in one year for Duchess Skylark Ormsby (world's record).

The minimum individual production henceforward required for the championship is as follows : for mature cows, 44.42 lbs butter in 7 days and 1 506 lbs in a year; for two-year-old cows, 31.4 lbs in 7 days and 1 200 lbs per year.

The meeting adopted resolutions in favour of the association providing for the creation of a body of inspectors under its control, instead of relying upon those of the State Colleges and experiment Stations.

The distribution of prize money absorbed a sum of more than $ 15 000 ; advertising expenses exceeded $ 25 000.

Furthermore, the meeting approved a resolution in reference to the introduction in the Herd-Book of the 305 days' test, according to the rules in force for the 365 day's test, but independently of this latter. This period was sufficient to test the continuance in milk, and the advantage was thus secured of making annual calving possible even in animals subjected every year to a production test.

The annual meeting will in the future be held alternately east and west of the 18th degree of longitude, and in 1917 at Worcester.

996 – **The Portuguese Cattle Breeds Barrosa and Maronesa.** — De Lacerda Pizarro Agostinho José Freire, in *Revista de Medicina Veterinaria*, 15th Year, No. 173, pp. 129-134, Lisbon, July 1916.

The Barrosa breed (in the Barros region) belongs to the district of the Minho and part of that of Oporto ; the Maronesa race is a native of the district of the Douro.

According to the writer the Barrosa breed in its present state shows cranial characters similar to those of *Bos mauritanicus*, and has very fully developed and large horns.

From a comparison between the two breeds the Barrosa breed exhibits the following features : wider head, horns twice the size and pointed directly upwards from their root ; the vertex of the frontal protuberance nearer to the median line ; shorter face ; smaller size of naso-maxillary suture ; the presence of a frontal crest, more prominent orbits. The head is dished in both breeds. The line of the upper edge of the neck, especially in its front part, is concave in the Barrosa and almost straight in the Maronesa. The dorso-lumbar line and the tail insertion are identical ; the Barrosa breed has straight or slightly hollowed buttocks, the Maronesa straight or slightly convex ones. The limbs of the Barrosa are finer, as its skeleton is more slender ; its meat yield may amount to 65 % of the live weight, which is never reached by the Maronesa. The Barrosa breed has less capacity for resisting heavy labour ; it is much more suitable for dairy purposes (cows are found which when in full milk yield from 2.6 to 3.1 galls of milk per day, with 5 to 6 % of fat). According to the measurements made by the writer, the Barrosa breed presents the following average dimensions :

| | |
|---|---|
| Length of head | 15.74 ins. |
| Width of fore-head | 11.42 ins. |
| Height of withers | 51.18 ins. |
| Coxoscapular length | 60.63 ins. |
| Circumference of chest | 80.73 ins. |
| Height of chest | 31.71 ins. |
| Width of ribs | 18.11 ins. |
| Maximum width of belly | 84.64 ins. |
| Initial width of pelvis | 16.93 ins. |
| Dactylothoracic index | $^1/_{10}$ to $^1/_{10.8}$ lbs. |
| Live weight | 15.40 to 21.56 lbs. |

Therefore this is a breed with dished face, short lines and eumetric (according to Sanson, brachycephalic).

The writer holds that the " Barrosãos " cattle form a true race, but that on the other hand the " Maronesos " are the result of a cross between the Barrosa and Mirandesa breeds. He is led to this conclusion both from

observation of the animals and from the fact observed by him that the product of crossing these two races actually presents the characters exhibited by the Maronesos.

997 – **Experiments in Pig-Feeding carried out by the Experimental Sub-Station of North Platte, Nebraska, United States.** — SNYDER W. P. and BURNETT E. A., in *Bulletin* No. 147 *of the Agricultural Experiment Station of Nebraska*, Vol. XXVII, Art. IV, 56 pp. (Limited Edition); 31 pp. (Popular Edition). Lincoln, Nebraska, 1915. PIGS

Report on experiments in pig rearing in 1912, 1913 and 1914. To allow of comparing these results with those already set out in the previous bulletins of the same Station, there were adopted (in all cases where not otherwise indicated) the same unit prices as in previous years, namely :

TABLE I.

| | |
|---|---|
| Pigs per 100 lbs. | $5.90 |
| Maize per bushel | 0.47 |
| Wheat " " | 0.70 |
| Barley " " | 0.40 |
| Rye " " | 0.56 |
| Oil meal per ton | 30.00 |
| Butcher's offal per ton | 40.00 |
| Shorts per ton | 24.00 |
| Lucerne hay meal per ton | 15.00 |
| Chopped lucerne hay per ton | 10.00 |
| Lucerne hay per ton | 8.00 |

*Wintering old brood Sows.* — It was desired to make a comparison between a ration of chopped lucerne hay mixed with an equal weight of ground grain, and of feeding the lucerne hay in a rack (*ad libitum*) and shelled maize in a trough. Each ration was given to 10 sows from the beginning of November to March (average 121 days) in four consecutive years. It is proved by the average of the four years that 9.9 bushels of maize and 86 lbs of lucerne hay, or 8.84 bushels of maize and 495 lbs of chopped lucerne hay were required to maintain a sow weighing 387 lbs during 4 winter months and to increase its live weight by about 95 lbs. The feeding of a light grain ration and of lucerne hay *ad libitum* was found to be more economical than the feed with which it has been compared.

*Wintering young brood Sows.* — During 5 consecutive winters gilts were given *ad libitum* a mixture of 1 part by weight of chopped lucerne hay with 2 or 3 parts of grain. The proportion of grain was reduced when the sows looked like becoming over-fleshy. Each group comprised 20 to 25 sows. The experiments began about the 10th November and ended about the end of March or beginning of April, a little before littering. There was found on the average :

TABLE II. — *Wintering cost of young Sows with farrow.*

| | |
|---|---|
| Weight of sows at the beginning of experiment | 178 lbs |
| " " " at the end " " | 300.3 lbs |
| Average daily increase per head | 0.91 lbs |
| Cost of feeding to produce 100 lbs of gain in weight | $5.30 |

To produce 100 lbs of gain, 477 lbs of grain and 181 lbs of alfalfa were required.

The net wintering cost of a young sow was less than that of an old sow, because the former shows a more rapid increase of live weight.

*Cost of feeding the porkling from birth until the time when it reached the weight of* 50 *pounds.* — A comparison was made between porklings born of 18 old sows and others born of 24 young sows. The particulars of Table III are the average of a period of 4 years for the former and 5 years for the latter. The porklings were debited with the cost of feeding of the sows from autumn to the time when they weighed 50 lbs (end of the experiment), plus the cost of feeding the porklings from weaning until the end of the experiment. The difference between this total and the value of the increase of live weight of the sows during the period of experiment forms the cost of production of the porkling weighing 50 lbs.

TABLE III. — *Average Cost of Porklings weighing* 50 *lbs.*

| | Born of old sows — | Born of young sows — |
|---|---|---|
| Increase in live weight of sows during period of experiment | 62 lbs | 101.4 lbs |
| Cost of feeding sows and porklings | $17.41 | $16.41 |
| Number of young born at each litter | 11.1 | 8.2 |
| Weight of young at birth | 2.4 lbs | 2.31 lbs |
| Number of porklings which lived to the end of the experiments | 6.55 | 6.2 |
| Age at which the weight of 50 lbs was attained | 89 days | 99 days |
| Cost of food consumed for the production of this weight | $2.11 | $1.68 |

*Comparison between the cost of production of the autumn-born porkling and the spring-born porkling.* — For 4 years a comparison was made between 579 spring pigs born from old sows, 543 spring pig from young sows, and 153 autumn pigs from young sows. Their average costs of production (from the moment immediately preceding littering until the time when the porklings reached the weight of 50 lbs.) were $2.05, $1.81 and $2.03 respectively. As compared with the old sows and their porklings, the young sows consumed less grain. They reared nearly as many young, and the latter increased in live weight with an almost equal rapidity.

TABLE IV. — *Comparison between the cost of pigs from old sows and those from young sows.*

| | From old sows | From young sows |
|---|---|---|
| From autumn to the time when the porklings weighed 50 lbs . . | $2.11 | $1.68 |
| From immediately before birth until the above time . . . . . | $2.01 | $1.81 |

The young sows produce the porklings at a cheaper cost, above all because, being less in bulk, they require a smaller maintenance ration, and they and their young convert a larger proportion of the food into increase in live weight.

*Cost of rearing pigs on lucerne pasturage supplemented by a grain ration, during the summer.* — The observations bore on 1 345 pigs divided into 50 groups. The results show that the rate of increase of live weight is closely connected with the quantity of grain consumed, and that the cost of the increase of live weight rises with the rate of such increase. The lucerne pasture is cheap and the grain ration is expensive. The increase in live weight is cheap or dear according as it is produced principally by the former or the latter means. A ration of less than 2 lbs of grain per day per 100 lbs of live weight may produce pigs poor in growth. The average of the results is set out in Table V.

TABLE V. — *Rearing pigs with lucerne pasturage and grain.*

| Daily ration of grain per 100 lbs. of live weight | Daily increase of live weight per head | Quantity of grain consumed to produce 100 lbs. increase in live weight |
|---|---|---|
| 2 lbs | 0.56 lbs | 260 lbs |
| 2.5 | 0.73 lbs | 312 lbs |
| 3 | 0.90 lbs | 389 lbs |

*Shorts for pigs kept during summer on lucerne pasturage.* — A supplementary ration of maize alone (grain) is compared with another ration made up of $^3/_4$ maize and $^1/_4$ shorts, and yet another ration made up of half maize and half shorts. In the first case, the ration of maize alone produces somewhat more rapid increases of live weight at a slightly less cost ; in the second case, rather better results were obtained with the ration of maize and shorts, but the difference was always small. It is not desirable to replace maize by shorts if the latter costs no less than the former.

*Dry or soaked maize for lucerne-pastured pigs.* — Soaking the maize grains does not give any advantage.

*Food consumed during summer by boars.* — A ration of 2.5 lbs of grain per day was fed per 100 lbs of live weight to lucerne-pastured boars. They consumed 339 lbs of grain per 100 lbs increase of live weight. The increase of live weight per head per day was 0.92 lbs. ; at the end of the autumn the pigs weighed on the average 171 pounds each.

*Maize and supplementary feeds for pig fattening.* — From the 14th November 1911 to the 27th February 1912, the rations 1 to 10 of Table VI were again distributed in the following winter and ration 11 was also tested. Lucerne hay was given ad libitum.

TABLE VI. — *Maize (corn) and additional foods for pig-fattening*

| Group | Ration |
|---|---|
| 1 | Shelled corn (1911-1912) or shelled and crushed corn (1912-1913) |
| 2 | Ear Corn and lucerne hay |
| 3 | Ground corn and lucerne |
| 4 | Ground corn and lucerne hay |
| 5 | Ground corn 90 parts and lucerne meal 10 parts |
| 6 | Ground corn 90 parts and shorts 10 parts |
| 7 | Ground corn 90 parts and of oil meal (extracted by solvents) 10 parts |
| 8 | Ground corn 95 parts and butcher's offal 5 parts |
| 9 | Ground corn 90 parts, oil cake 10 parts, and lucerne hay |
| 10 | Ground corn 95 parts, butcher's offal 5 parts, and lucerne hay |
| 11 | Ground corn 90 parts and cotton seed cake (extracted by cold compression) 10 parts |

*Results.*

| Group | Average increase of live weight per head per day | | Weight of food consumed to produce 100 lbs increase of live weight | | Cost of production of 100 lbs increase of live weight | | Profit per pig | |
|---|---|---|---|---|---|---|---|---|
| | 1911-1912 | 1912-1913 | 1911-1912 | 1912-1913 | 1911-1912 | 1912-1913 | 1911-1912 | 1912-1913 |
| 1 | 0.78 | 1.22 | 610lbs | 494lbs | 5.13 $ | 4.19 $ | 0.64 $ | 2.34 $ |
| 2 | 0.79 | 1.52 | 586 | 424 | 4.80 | 3.50 | 0.92 | 3.99 |
| 3 | 0.78 | 1.52 | 603 | 446 | 4.93 | 3.36 | 0.80 | 3.78 |
| 4 | 0.90 | 1.33 | 597 | 482 | 4.93 | 3.93 | 0.93 | 2.86 |
| 5 | 1.00 | 1.24 | 536 | 497 | 4.45 | 4.13 | 1.53 | 2.41 |
| 6 | 1.05 | 1.34 | 511 | 461 | 4.47 | 4.04 | 1.59 | 2.72 |
| 7 | 1.24 | 1.41 | 467 | 445 | 4.23 | 4.03 | 2.20 | 2.88 |
| 8 | 1.25 | 1.46 | 469 | 441 | 4.21 | 3.96 | 2.25 | 3.08 |
| 9 | 1.26 | 1.41 | 487 | 455 | 4.29 | 4.08 | 2.13 | 2.81 |
| 10 | 1.26 | 1.47 | 484 | 447 | 4.14 | 4.00 | 2.35 | 3.04 |
| 11 | — | 1.48 | — | 454 | — | 4.00 | — | 3.07 |

*Corn and lucerne compared with corn, shorts, and lucerne in rearing and fattening pigs.* — The experiments comprised the periods: 1) from 5th September to 14th November 1911; the pigs, of an average weight of 112 112 lbs in the 1st group, and 115 lbs in the 2nd, were put out to lucerne pasturage, and were given: the 1st, 3.34 lbs of ground maize per 100 lbs live weight per day; the 2nd, 3.30 lbs of a mixture of $^2/_3$ corn and $^1/_3$ shorts per 100 lbs live weight per day. The pigs of the 1st group increased in live weight by 0.05 lbs more per head daily than those of the 2nd group, and consumed 10 lbs less grain per 100 lbs gain in live weight. 2) From 14th November to 2nd January, the pigs were kept in the sties; they were given as much lucerne hay as they wanted and 2.48 lbs of maize per 100 lbs for the 1st group. To the 2nd group 2.60 lbs of corn + shorts per 100 lbs were gfven; they increased 0.06 lbs more per head daily than the 1st group, and consumed 2 lbs of grain more per 100 lbs increase of live weight. In the two experiments together the two additional rations produced the same daily increase of live weight, and 16 lbs more of corn plus shorts were required (as compared with corn alone) to produce 100 lbs increase of live weight. At the prices contained in Table I, the profit obtained per head with the additional corn ration alone was almost double that obtained with the additional ration of corn + shorts.

TABLE VII. — *Wheat and rye compared with maize for fattening pigs with or without lucerne hay.*

| Ration | Average daily increase of live weight per head | Foods consumed to produce 100 lbs. increase of live weight | Cost of 100 lbs. increase of live weight | | Profit per pig | |
|---|---|---|---|---|---|---|
| | | | (1) | (2) | (1) | (2) |
| | lbs. | lbs. | $ | $ | $ | $ |
| Dry Shelled corn . . . . . | 1.11 | 479 | 3.97 | 5.47 | 2.11 | 2.49 |
| Dry whole wheat . . . . . | 1.02 | 519 | 5.99 | 5.98 | loss | 1.91 |
| Soaked » » . . . . . | 1.05 | 514 | 5.92 | 5.92 | loss | 1.80 |
| Moistened ground wheat. . . | 1.36 | 433 | 5.00 | 4.99 | 1.21 | 3.70 |
| Soaked » » . . . | 1.41 | 418 | 4.84 | 4.84 | 1.46 | 4.02 |
| Moistened whole rye . . . . | 0.88 | 558 | 6.51 | 5.50 | 0.34 | 1.97 |

(1) Prices takew at Corn 47*c*, Wheat 70*c* and Rye 50*c* per bushel. Hogs $5.90 per 100 lbs. — (2) Prices taken at Corn 65*c*, Wheat 70*c*, and Rye 50*c*, per bushel, Hogs $7.75 per 100 lbs.

*Addition of lucerne and residue of lucerne tea to a ration for wintering of castrated young pigs.* — The following comparisons were made: 1) lu-

cerne hay *ad libitum*+ration of 3 parts of corn and 1 of shorts reduced to a thick slop : *a*) with hot water ; *b*) with an infusion of lucerne hay ; 2) to the above basal ration there were added : *a*) infusion residue, *i. e.* lucerne hay stewed for an hour in hot water, and then drained ; *b*) the same quantity of chopped dry hay ; 3) *a*) ration of 90 parts of ground maize 10 parts of chopped lucerne hay mixed and reduced to a paste with boiling water ; *b*) the same quantity of corn and the same quantity of infused chopped lucerne hay (solid and liquid parts).

In the first two experiments the use of the lucerne infusion and the infusion residue proved of advantage ; in the third, it was only slightly so. To sum up, this operation cannot be advised in those cases where it would be very expensive.

TABLE VIII. — *Comparison between corn and: corn+shorts; corn+barley; corn+Triticum dicoccum ; corn+wheat ; corn+butcher's offal. — Average of all the results.*

| | Corn | Corn + shorts | Corn | Corn + barley | Corn | Corn + *T. dicoccum* | Corn | Corn + wheat | Corn | Corn+butcher's offal |
|---|---|---|---|---|---|---|---|---|---|---|
| Number of experiments made | 10 | 10 | 8 | 8 | 3 | 3 | 4 | 4 | 7 | 7 |
| Number of pigs experimented on . . . . . | 168 | 168 | 132 | 132 | 84 | 84 | 64 | 64 | 162 | 162 |
| Daily increase of live weight per head . . . . . lbs. | .94 | .94 | 1.19 | 1.10 | 1.33 | 1.14 | 1.30 | 1.22 | 1.17 | 1.45 |
| Weight of food required to obtain of 100 lbs increase of live weight . . . . . lbs. | 436 | 433 | 478 | 532 | 477 | 529 | 501 | 470 | 511 | 459 |
| Cost of 100 lbs gain of . $ | 3.36 | 4.07 | 4.04 | 4.48 | 3.95 | 4.48 | 4.01 | 4.53 | 4.26 | 4.08 |
| Profit per pig . . . . . $ | 1.70 | 1.34 | 1.78 | 1.26 | 1.95 | 1.38 | 2.33 | 1.71 | 1.83 | 2.45 |

998 - **Specific Effects of Different Rations on the Growth of Pigs ; Experiments at the Ohio Agricultural Experiment Station, United States.** — FORBES E. B., BEEGLE F. M., FRITZ C. M., MORGAN L. E. and RHUE S. N., in *Bulletin of the Ohio Agricultural Experiment Station*, No. 283, pp. 111-152, fig. Woster, Ohio, 1915.

Experiments in feeding followed by slaughter and analysis of the carcasses, carried out in pigs, in order to study the specific effect of rations

on the composition of the resulting increase of live weight. The rations are indicated in Table I.

TABLE I. — *Rations tried.*

1) Corn (maize) alone.
2) Corn and soya beans) in the ratio 10.82 : 1.
3) Corn and linseed oil meal (extracted with solvents) in the ratio of 9.36 : 1.
4) Corn and wheat middlings, in the ratio 2.81 : 1.
5) Corn and slaughter-house offal, in the ratio 18.84 : 1.
6) Maize and skim milk, in the ratio 0.882 : 1.
7) Control (killed at the beginning of the experiment).

These rations were fed so as to contain the same quantity of digestible matter per unit of live weight of the pigs. The feeds supplementing the corn were added in such quantities that the different rations had the same ratio between protein and starch value as the non-nitrogenous substances. Consequently this experiment served to a great extent for comparing the growing powers of pigs when they consume equivalent quantities of protein in different forms. For this purpose 35 pigs, all pure-bred Duroc-Jerseys, were used, divided into 7 groups of 5.

It was found that the capacity to produce increase of proteins is greater for the digestible protein of milk than for the digestible protein of the vegetable foods tried and slaughter-house offal.

The maize with supplementary ration of: soya, linseed oil meal, sharps, wheat middlings, slaughter-house offal, and skim milk, in such proportions that the nutritive value of the rations was 1 : 6.5, does not furnish mineral substances corresponding to what is required for the maximum growth of the bones, either as regards the nature or quantity of these substances.

Rations of corn alone, and corn + soya, produce the minimum in point of bone growth. Rations of corn + slaughter-house offal and corn + skim milk produce the maximum in this respect. Rations of grain alone do not produce a normal formation of bone.

Among all the groups chosen for the experiment, that which was given the corn and linseed oil meal gave the maximum percentage of meat and subcutaneous and peritoneal fat (on the whole), and the minimum percentage of bone, as compared with the entire skeleton completely strippedof meat.

The groups to which slaughter-house offal or skim milk was given had the maximum proportions of bone as compared with the entire meatless skeleton, with the exception of the groups to which corn alone or corn + soya was given, in which the larger proportion relatively to the skeleton was due not to a greater development of the bones, but to the inferior nutrition of the other tissues.

The proportions of lime, magnesia and phosphorus in the bone shows a great tendency to remain constant, but they may be modified within certain limits by the limitations applied in the feeding. Nevertheless, the absolute *quantities* of these elements in the bones are capable of a far greater modification as a result of the composition of the feed given.

The percentage of ash and the breaking strength of the bones varied on the following decreasing order: 1) maize+skim milk; 2) maize+slaughter-house offal; 3) maize+linseed oil meal; 4) maize; 5) maize+wheat middlings; 6) maize+soya brans. They are set out, in the order of groups, in Table II.

In all the groups except those which had received slaughter-house offal or milk, the bones contained less lime and phosphorus than in the control group (killed at the start of the experiment). The skeletons of the pigs which had wheat middlings (a food very rich in magnesia) contained more magnesia than those of the control group.

The ration of corn alone produced less moisture, protein and ash, and more fat in the meat, than all the other rations of corn+supplementary food. At the opposite end of the series is the ration of corn+skim milk, which produced the maximum moisture and protein and the minimum of fat in the meat.

TABLE II. — *Percentage of ash and breaking strength of bones.*

| | Percentage of ash in the bones | | Breaking Streugth | |
|---|---|---|---|---|
| | natural state | freed from water | of the femur | of the tibia |
| 1 | 24.1790 % | 41.3811 % | 198.17 kg | 208.65 kg |
| 2 | 23.8160 | 38.6059 | 191.01 | 189.15 |
| 3 | 20.5020 | 32.9561 | 157.58 | 157.08 |
| 4 | 20.3940 | 33.2637 | 154.67 | 149.73 |
| 5 | 19.0330 | 34.9358 | 150.86 | 144.24 |
| 6 | 19.2560 | 32.5435 | 141.52 | 133.72 |

There is a great variation, which appears to be caused by feeding, in the quantity of the mineral constituents of the meat and blood.

Half of each carcass was salted and treated for preservation. It was observed that the foods had produced great differences in the compactness of the loins and sides, and some effect on their behaviour during cooking, together with a slight effect on the good quality of the meat when cooked.

A complete analysis of one half of each carcass was made. The results obtained show the existence of a specific effect on the proportions of the principal parts forming the tissues. The results are shown in Table III.

Complete histological analyses of the blood of each pig were made. Certain individual differences were referred to the condition of nutrition of the animals forming part of one and the same experimental group.

Other observations were considered as being specific or characteristic of the group and the ration.

The quantity of catalase contained in the most important organs and tissues was estimated, and certain differences were noted between the results given by the different groups subjected to the experiment.

One of the most important facts resulting from this study and others previously carried out at the same Station (Bulletin 271) relates to the use of lime in agriculture. It is rendered obvious that cereals are very poor in lime regarded as an element of the food of animals, as it has been clearly proved that the normal growth of the skeleton cannot be produced by grain. This calls special attention to bulky leguminous forages ; as they contain a great deal of protein and a proportion of lime which no other forage

TABLE III. — *Effects of the ration on the principal constituent parts of the tissues.*

| Ration | Ratios between protein and fats in the meat (ether extract) | Ratios between protein and ash in the bone | Ratio between protein, fats and ash in the carcass |
|---|---|---|---|
| 1 | 1 : 6.66 | 1 : 1.130 | 1 : 5.12 : 0.178 |
| 2 | 1 : 5.65 | 1 : 0.957 | 1 : 4.45 : 0.170 |
| 3 | 1 : 6.30 | 1 : 1.139 | 1 : 4.95 : 0.169 |
| 4 | 1 : 5.87 | 1 : 0.928 | 1 : 4.43 : 0.159 |
| 5 | 1 : 6.34 | 1 : 1.171 | 1 : 4.88 : 0.197 |
| 6 | 1 : 5.03 | 1 : 1.171 | 1 : 3.93 : 0.179 |
| 7 | 1 : 4.52 | 1 : 1.076 | 1 : 3.36 : 0.199 |

furnishes, they form the ideal natural supplementary food to be used with grain. The growth of *Leguminosae* depending on conditions resulting from the presence of calcium compounds in the soil and these plants taking large quantities of that element from the soil, the normal growth of animals stands in a natural relation to the fundamental question of the use of calcium compounds in agriculture.

999 – **Wheat as a Food for Fattening Pigs ; Experiments in Missouri, United States** (1). — WEAVER L. A., in *University of Missouri, College of Agriculture, Agricultural Experiment Station, Bulletin* 136, 35 pp., 8 fig. Columbia, Miss., 1915.

In 1913 the wheat crop was very plentiful and the maize crop very poor in the State of Missouri, so that the price obtainable by the farmer for the former was less than the purchase price of the latter. The Agricultural Experiment Station of Missouri received many enquiries from farmers con-

(1) See also *B.* May 1915, No. 540. (*Ed.*)

cerning the comparative value of wheat and maize as a food in the fattening of pigs, and the best method of feeding wheat to them.

In 1914, the continuous rains at the end of the summer and beginning of the autumn damaged a large part of the wheat harvested in the State of Missouri, and reduced its value to such an extent as to make its use as a pig food economically desirable.

The experiments included numerous and variously combined feeding tests, accompanied by the slaughter of standard animals belonging to each of the group experiments. The purpose of these experiments was: 1) to compare the food value of maize and wheat; 2) to obtain particulars as to the food value of wheat fed alone or together with other foods rich in carbohydrates; 3) to obtain data as to the food value of wheat along with foods rich in protein and mineral substances.

The results are contained in 30 tables and are summed up as follows:

In this experiments pigs fed on wheat increased in weight more rapidly than those fed with maize.

During the entire feeding period of 120 days the wheat-fed pigs showed an average daily gain of 1.25 lbs per head as against 1.00 lbs for those fed on maize.

To produce 100 lbs increase of live weight there was required 483 lbs of wheat as against 582 lbs of maize in the like conditions.

A mixture of wheat and maize in equal parts appeared to be more suitable in point of rapidity and economy of increase of live weight than maize alone, but less than wheat alone.

A ration of maize 10 parts and butcher's offal one part produced more rapid increase of weight than maize alone.

During the 120 days of the feeding period, the ration consisting of 10 parts of maize + 1 part of butcher's offal produced an increase of live weight of 1.27 lbs per head per day, as against 1 lb with the maize ration alone.

To produce 100 lbs increase of live weight a lesser quantity of grain was needed when the maize was supplemented by butcher's offal. In this experiment, 498 lbs of a ration consisting of 10 parts of maize and 1 part of butcher's offal produced the same increase of live weight as 582 lbs of maize alone under like conditions.

The addition of butcher's offal to the wheat ration showed a clear advantage during the first part of the feed test.

During the first 78 days of the experiment, the ration 10 parts of wheat + one of butcher's offal gave an average increase of live weight of 1.55 lbs per day, while the ration of wheat alone produced 1.25 lbs. During that period, in order to produce 100 lbs increase of live weight, there were required 424 lbs of the ration wheat+butcher's offal as against 455 lbs of wheat ration alone.

During the last 42 days of the experiment, the pigs fed on wheat and butcher's offal also showed a more rapid increase of live weight, namely, 1.53 lbs per head per day as against 1.26 lbs with wheat alone. This surplus in the increase of live weight was not very, or rather not at all, economic. During this period, to produce 100 lbs increase of live weight there were re-

quired 543 lbs of the ration of wheat alone, or 562 lbs of the ration wheat + butcher's offal.

A ration of wheat 10 parts, butcher's offal one part produced more rapid increase of live weight than a ration of wheat 5 parts, maize 5 parts and butcher's offal 1 part, or a ration of maize 10 parts, butcher's offal 1 part. Furthermore, the increase of live weight was more economical. In a similar way, the ration 5 parts of wheat, 5 of maize and 1 of butcher's offal was more effective than the ration 10 parts of maize and 1 of butcher's offal.

469 lbs of the ration wheat + butcher's offal produced 100 lbs increase of live weight at the rate of 1.52 lbs per head per day. 458 lbs of the ration wheat + maize + butcher's offal were needed to produce 100 lbs increase of live weight at the rate of 1.44 lbs per head per day. Finally, 498 lbs of the ration maize butcher's offal were needed to produce 100 lbs of live weight at the rate of 1.27 lbs per head per day.

1000 – **Egg-laying Competition in Australia.** — I. HART A., Results of the 5th Egg-laying Competition held in the State of Victoria, Australia, in 1915-1916 (1), in *The Journal of the Department of Agriculture of Victoria*, Vol. XIV, Part 6, pp. 329-340, 8 fig. Melbourne, June 1916. — II. THOMPSON D. S., Results of the 4th Egg-laying Competition held at the Grafton Experiment Farm, New South Wales, in *The Agricultural Gazette of New South Wales*, Vol. XXVII, Part 6, pp. 433-437. Sydney, June 1916. POULTRY

I. — One year competition (April 1915-April 1916) held at the Burnley School of Horticulture, in which 570 hens took part, in groups of 6, divided into 3 sections : 1) light breeds, wet fed (56 groups) ; 2) light breeds, dry fed (19 groups) ; 3) heavy breeds, wet fed (20 groups). The wet fed hens were, in the morning, given a mash consisting of crushed oats, sharps, pea meal, oat shorts and chopped liver ; at noon, the same mash mixed with lucerne and chopped beetroots ; in the evening, a mixture of grain. The dry fed hens received a ration consisting of about the same constituents, but simply mixed together and not reduced to a mash. The difference between the groups subjected to the two forms of feeding was slight, and far less than in the preceding year. This proves that dry feeding, provided it is properly constituted and well balanced, is quite as suitable as wet feeding, and that the selection of the feeding should therefore be according to the conditions of the locality.

The total number of eggs laid during the year by the 570 hens (20 died before the end of the competition and were not replaced) was 125 119, of which 75 900, or about 226 per hen, were furnished by the 336 hens of the 1st section. The 114 hens of the 2nd section laid 25 164 eggs, or an average of 200.7 per hen.

The 120 heavy breed hens of the 3rd section laid 24 055 egs, or an average of 200.5 per hen.

The light breeds were exclusively represented by the White Leghorn ; the heavy breeds by the Black Orpington, Rhode Island Red, Faverolle, Silver Wyandotte, White Wyandotte, and White Orpington.

(1) See also : *B.* 1915, No. 945. (*Ed.*)

The 3 best groups in each section gave the results indicated in Table I.

TABLE I. — *Results given by the 3 best groups in each section.*

| Breed | Total number of eggs laid | Average weight of a dozen eggs |
|---|---|---|
| *1st Section.* | | |
| White Leghorn | 1 661 | 694 gr. |
| Do. | 1 637 | 661 |
| Do. | 1 623 | 678 |
| *2nd Section.* | | |
| White Leghorn | 1 638 | 666 gr. |
| Do. | 1 601 | 646 |
| Do. | 1 457 | 708 |
| *3rd Section.* | | |
| Black Orpington | 1 507 | 725 |
| Do. | 1 447 | 686 |
| Rhode Island Red | 1 423 | 700 |

The maximum productions obtained up to the present in Australia in Government controlled competitions are those indicated by Table II (number of eggs laid in one year by a group of 6 hens).

TABLE II. — *Maximum production obtained hitherto in controlled competitions in Australia.*

| State | Breed | Number of eggs |
|---|---|---|
| South Australia | White Leghorn | 1 589 |
| West Australia | Do. | 1 564 |
| New South Wales | Do. | 1 541 |
| Queensland | Do. | 1 564 |
| Victoria | Do. | 1 699 |
| New Zealand | Do. | 1 632 |
| Victoria | Black Orpington | 1 562 |

This last competition also brings out clearly the rapid and continual improvement of the White Leghorn as a laying breed in the State of Victoria. The winning group of the Dookie College competition in 1904-1905 laid 1313 eggs in 1 year; in the last competition, the winning group laid 1 661, and the first 5 groups laid 8 160, or an average of 272 eggs per hen.

II. In the 1 year competition ended on the 31st March 1916 there took part : *a*) 19 groups of 6 hens in their 1st laying year ; *b*) 22 groups of hens in their 2nd laying year which had already competed in the previous year. The breeds represented were : White Leghorn, Brown Leghorn, Black Orpington and Silver Wyandotte.

The year was remarkable for an exceptional drought, and the green food had to be reduced. The hens were given in the morning a hash of sharps, bran and flour with a little salt ; in the evening a mixture of wheat and maize ; liver once a week ; crushed shells to any amount ; and often epsomite (natural magnesium sulphate) dissolved in water.

The results were not so good as those of the preceding year. The general average obtained was 168 eggs per hen against 182 in the preceding year. The 1st two groups of hens respectively produced during the 1st productive year 1265 eggs, weighing 680 grms per dozen, and 1227 eggs weighing 708 grms per dozen. During the 2nd year of production, the 1st 2 groups of hens respectively have 2144 eggs weighing 680 grms per dozen, and 2055 eggs with the same average weight. In Table II a comparison has been made of the results of the last 3 competitions, indicating the average number of eggs per hen in the different months.

TABLE III — *The Results of three Egg-laying Competitions held at the Grafton Experiment Farm. — Average number of Eggs laid per month.*

| | 1913-1914 | 1914-1915 | 1915-1916 |
|---|---|---|---|
| April | 6.9 | 9.9 | 8.2 |
| May | 14.3 | 15.8 | 7.1 |
| June | 11.0 | 10.4 | 10.2 |
| July | 16.4 | 15.8 | 13.8 |
| August | 21.3 | 20.8 | 16.2 |
| September | 21.3 | 21.0 | 18.1 |
| October | 21.3 | 21.7 | 21.9 |
| November | 19.2 | 20.7 | 16.9 |
| December | 17.2 | 16.9 | 15.6 |
| January | 17.0 | 11.2 | 18.3 |
| February | 13.2 | 10.7 | 13.6 |
| March | 10.6 | 6.6 | 8.2 |

1001 - **Experiments in Breeding different Races of Silkworms, at the Silkworm Station of Puerto de Santa Maria (Seville, Spain).** — *Boletín de Información de la Estación sericícola*, IVth year, No. 6, p. 3. Puerto de Santa Maria, June 30, 1916. SERICULTURE

The Table appended sums up the principal results of these experiments.

*Results of Experiments.*

| Races bred | Weight of cocoons obtained from 1 ounce of eggs | | | Average weight of a cocoon | Ratio between weight of silk cocoon and that of chrysalis | Proportion of constricted cocoons |
|---|---|---|---|---|---|---|
| | normal | constricted | with poorly developed points | | | |
| Var N° 1 | 78 653 g | 486 g | 1 065 g | 1.976 g | 1 : 5.841 | 0.3 % |
| Var N° 3 | 79 215 | 1 217 | 821 | 2.019 | 1 : 5.838 | 1.5 |
| Var N° 5 | 81 792 | 420 | 1 607 | 2.132 | 1 : 5.809 | 0.5 |
| Var N° 15 | 76 796 | 789 | 1 456 | 1.759 | 1 : 4.761 | 1 |
| Var, acclimatised in Spain | 73 095 | 1 535 | 2 184 | 1.983 | 1 : 5.218 | 2 |
| Ascoli Piceno N° 1 | 80 886 | 415 | 846 | 2.020 | 1 : 4.824 | 0.5 |
| Ascoli Piceno N° 2 | 86 280 | 671 | 1 049 | 2.240 | 1 : 5.415 | 0.75 |
| Ascoli Piceno, acclimatised in Spain. | 76 181 | 2 504 | 746 | 1.910 | 1 : 5.758 | 3 |
| Milan. | 76 556 | 3 221 | 846 | 2.150 | 1 : 5.520 | 4 |
| Milan, acclimatised in Spain | 69 798 | 3 196 | 2 214 | 2.020 | 1 : 5.350 | 4.25 |
| Perusa | 68 764 | 2 041 | 2 114 | 2.092 | 1 : 6.390 | 2.8 |
| Fuentes Tijola | 62 262 | 651 | 1 914 | 2.040 | 1 : 5.940 | 1 |
| Spanish with black adults | 61 632 | 1 307 | 1 080 | 1.987 | 1 : 6.150 | 3 |
| Campocroce Cross No. 1 | 74 633 | 4 021 | 784 | 1.800 | 1 : 5.880 | 5 |
| Campocroce Cross No. 2. | 74 717 | 1 929 | 382 | 1.750 | 1 : 5.660 | 2.5 |
| Campocroce Cross No. 3 | 71 134 | 1 741 | 3 429 | 1.750 | 1 : 5.330 | 2.23 |

FISH CULTURE.

1002 – **The Migration of Fish of the Genus *Mugil*, in the Lakeof Thau** (1). — ROULEL LOUIS, in *Comptes-Rendus des Séances de la Société de Biologie*, Vol. LXXIX, No. 11, pp. 522-525. Paris, June 1916.

The complete migration of these fish includes two displacements in inverse directions, one outward, from the lake to the sea, the other inward, from the sea to the lake. The outward migration takes place during the second half of the summer (August and September) ; it is connected with sexual development, the individuals passing out of the briny waters of the lake into sea water being chiefly breeding fish, the genital organs of which are already bulky. Their sexual maturation and spawning takes place at sea. The inward migration occurs during the winter and the first half of spring, its principal movement lying between February and April. The individuals then passing from the sea water to the brackish waters of the lake belong to two categories : one are recently hatched fry from the spawn resulting from previous outward migrations ; the others are immature adults

(1) See also *B.* May 1916, No. 543. (*Ed.*)

which may, from their appearance, be regarded as the breeders in the previous outward migrations, who return to the lake after spawning. The *Mugil* thus present the characteristic migratory type which the writer has termed " thalassotoccic " ; they normally live in an environment of brackish or almost fresh water, pass out into the sea water for reproduction, then after spawning return to their normal habitat.

In their outward migration the individuals pass from a less salt into a more salt environment, from an environment with higher to one with lower temperature ; the opposite is the case however (or, as regards temperature, at any rate there is equality between the two environments) at the time of the inward migration. Apparently, therefore, the differences in relation to saline character and temperature play no predominating part in the phenomenon of migration, since the displacements take place both in the positive and negative direction in reference to these conditions.

This is no longer found to be the case however with regard to dissolved oxygen. The researches of the writer on the outward migration have shown that the sea water of the coast at that time is always richer in oxygen than the water of the lake. In the same way, at the time of the inward migration the saltish water of the lake is richer in dissolved oxygen than that of the sea. In both cases, the two inverse displacements have the common condition of being directed from a less oxygenated environment towards an environment better provided with dissolved oxygen.

The displacement of the migratory fish in both directions does not take place at haphazard, but is connected with the presence and duration of the currents existing between the sea and the lake. At the time of the outward migration the majority of the migrating fish only go to the sea when the sea water currents flow towards the lake, and they pass up these currents swimming against the stream. In the same way, at the time of the inward migration, the principal displacement towards the lake is effected against the current when the waters of the lake are passing to the sea. The whole thing takes place just as if the migratory fish did not decide to travel and accomplish their migration until after they had been touched by waters dissimilar from those in which they had hitherto been, and as if such migration only consisted in their maintaining themselves in this new environment, passing along it by gradual stages until the place from which it has its origin is reached.

These considerations lead to several conclusions bearing on the migration of fish :

1) The *Mugil* of the lake of Thau exhibit a simplified type of reproductive or genetic migration, as they need only travel a few miles to accomplish spawning. This type, however, is complete ; the indications it provides for simplification are therefore of great importance, as accessory circumstances to which otherwise one may be tempted to attach great importance did not here come into operation.

2) This reproductory migration, in its two inverse directions, possesses an external determining cause, due to the direct action of the surrounding medium. In order that it may take place, it is essential that the

alternating currents set up between the sea and the lake should exercise a differential excitation on the individuals who have reached the stage of readiness for migration. This migration therefore clearly bears a character of tropism, as the immediate influence of the environment plays a preponderating part.

3) This tropism is chiefly of a respiratory kind, as the individuals, whatever the direction of their movement, always pass from an environment poorer to one richer in dissolved oxygen. These conclusions are not merely interesting with regard to the special case of the *Mugil*. They also bear on several other migratory fish, the journeys of which are longer and more complex. It may be readily assumed as regards these latter that the cause of the migration consists either in a reproductive instinct which forces the genetic individuals towards an environment necessary for the future development of their spawn, or in an inherited memory which would call these individuals back to the ancestral environment at the time of their reproduction. None of these reasons of a psychic character and hypothetical nature could be pleaded with regard to the *Mugil*, the migrations of which, as has been seen, have for their principal cause a tropism of a respiratory character. The writer, from the previous observations the series of which he is now continuing, holds that this cause is likewise the one governing the spawning migration of the *Salmon*.

The method of biological investigation which seeks to establish the curves of variation of the differential circumstances of environments in problems of this kind, and to follow the variations in these curves in order to determine those which constantly agree with the variable and successive dispositions of the individuals is the only one which can produce reliable results. These results are of two-fold importance, scientifically in respect to the theory of migration, and practically with regard to fish breeding and fisheries, provided that they are based on numerous and repeated observations so as progressively to eliminate with certainty all secondary circumstances of the character of mere coincidence. The writer therefore proposes to continue these researches, and to undertake them on a larger scale, in order to arrive at the most precise possible conclusions as to the determining causes of migration.

## FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

1003 - **Production of Agricultural Machinery in the United States in 1914.** — *Farm Implement News*, Vol. XXXVII, No. 25, p. 15, 1 table. Chicago, June 22, 1916.

The Census Office of the Department of Commerce in the United States has published a preliminary summary of the results of its enquiry into this production in 1914, compared with 1909.

Replies to the list of questions of the Department were sent by 772 works which manufactured agricultural machinery in 1914, to an aggregate value of $168 120 632. In 1909 returns, the corresponding figures had been

854 works and $149 318 544, so that during the last five-year period the value of the annual production increased $18 802 088, or 12.6 %.

The machines which mainly contributed to this increase are enumerated n Table I.

TABLE I. — *Machines with maximum increase of production from* 1909.

| Classes of Machines | Number of machines nade | | Percentage increase |
|---|---|---|---|
| | in 1909 | in 1914 | |
| Reapers | 136 022 | 215 386 | 58.3 % |
| Spring-tooth harrows | 114 341 | 118 247 | 64.6 |
| Drills | 144 616 | 199 805 | 38.2 |
| Corn (maize) huskers and shredders | 1 298 | 4 338 | 234.2 |
| Maize harvesting machines | 19 819 | 52 087 | 162.8 |
| Bean harvesting machines | 1 650 | 3 605 | 118.5 |
| Cotton sowers | 81 826 | 101 256 | 23.7 |
| Potato planters | 23 142 | 37 276 | 61.4 |

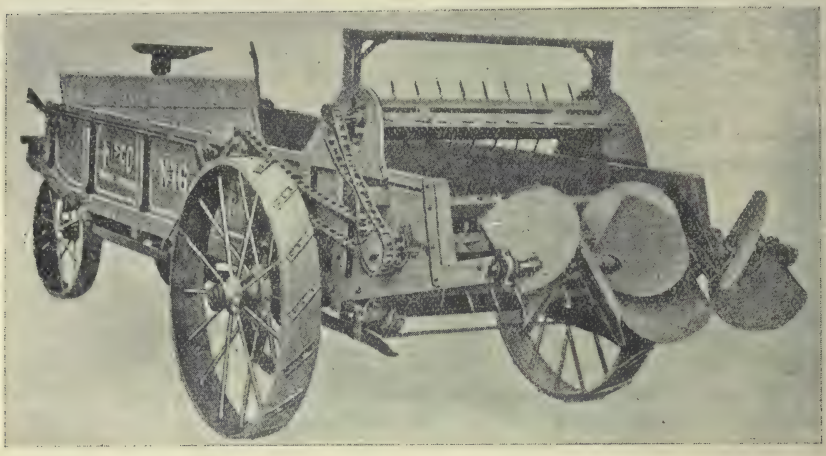
Table II gives a comparison, for 1909 and 1914, of the value of the production of the principal classes of machines and of the total production.

TABLE II. — *Compared value of the production of agricultural machines in* 1909 *and* 1914.

| | Year 1909 (854 works) | Year 1914 (772 works) | Percentage increase (+) or reduction (—) (— 9 %) |
|---|---|---|---|
| Tilling machines | $ 37 410 595 | 39 632 903 | + 5.9 |
| Planters and sowers | 12 306 207 | 12 268 156 | — 0.3 |
| Harvesting implements | 35 250 840 | 40 561 472 | + 15.1 |
| Machines for separating grains and seeds (threshers, etc.) | 11 588 986 | 13 986 184 | + 20.7 |
| Other machines and spare parts for machines of every description | 46 619 354 | 60 211 327 | + 21.3 |
| Repairs | 3 142 562 | 1 460 590 | — 53.5 |
| Total value of production | $ 149 318 544 | 168 120 632 | + 12.6 |

1004 - **"Nisco" Manure Spreader.** — *The Implement and Machinery Review*, Vol. 42, No. 494, p. 197, 1 fig. London, June 1st, 1916.

In this machine, built by the New Idea Spreader Company Ltd., at Guelph, Canada, the caracteristic part is the spreading mechanism, which lies behind the cart : it consists of a winged-rotating distributor (made of steel), which, in revolving, spreads the manure over a width of about 6



« Nisco » Manure Spreader.

to 7 feet, and also crushes the lumps of manure which might have passed intact between the 2 spiked pulverising cylinders which feed the spreader regularly and uniformly.

These 2 mechanisms are driven by 2 endless chains driven from the rear wheels of the cart.

The machine can be adjusted so as to spread 3 to 18 cart-loads of manure per acre.

1005 - **Fore-carriage for Harvesting Machines.** — KNOBLOCH WILHELM, in *Deutsche Landwirtschaftliche Presse*, 43rd Year, No. 62, pp. 516-517, 2 fig. Berlin, August 2, 1916.

The fore-carriages constructed in agricultural machine workshops are generally complicated and consequently expensive. To provide even the small farmer with the advantages of a good fore-carriage, the writer has designed a simple, practical and inexpensive arrangement of this kind, which can be built by any village smith. Figures 1 and 2 show the fore-carriage in a plan view and longitudinal section respectively.

The axle *a* is a simple square bar of iron (30 × 30 mm), carrying wheels *b*, 1 metre apart ; the wheels of a scarifier may answer the purpose perfectly. In the middle of the axle a hole is bored in which a strong pivot pin *c* (from 20 to 25 mm in diameter) engages, fitted in the middle with a washer 20 mm in height, and locked above by a flat key, and below by a nut.

To the axle there is rigidly connected the shaft *f*, which carries the swing-trees *g* and the cross-member *h*. Instead of the shaft fitted previously to the harvester *l*, there is a U-shaped iron piece 2 m in length, the front part of which is swanneck-shaped while the rear part carries a wood piece 65 cm in length screwed to the U-iron. The curved front part of the iron U-piece carries a flat iron square *i* of 50 × 10 mm riveted to it, and pierced with a 25 to 30 mm hole to take the pivot pin. Further, to the U-iron there is also screwed a solid iron rod *m* 1.3 metres in length, to prevent the rakes from fouling the guides when the vehicle turns.

*Fore-carriage for Harvesting Machines, Knobloch type.*

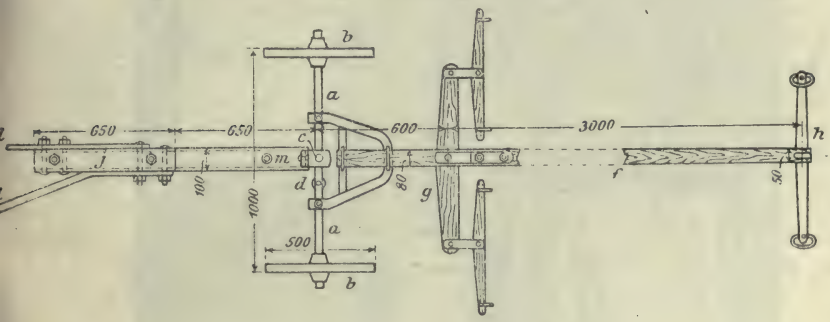



Fig. 1

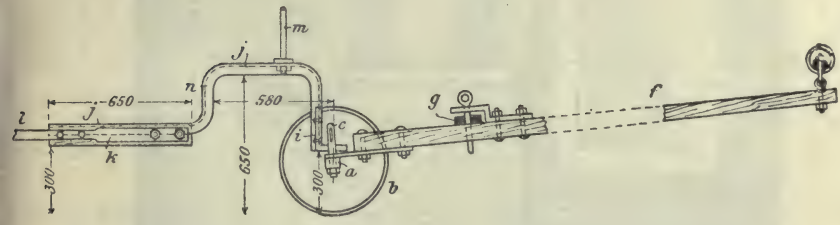



Fig. 2

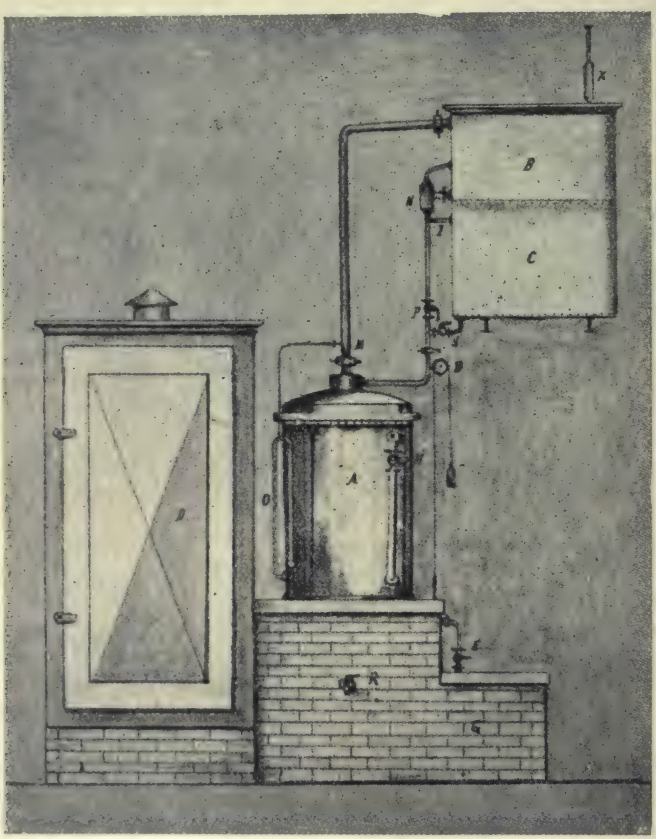
This fore-carriage may also be used for mowing machines. For this purpose the axle has a second hole *d*, 10 cm from the centre, in which the pivot pin *c* engages.

The shaft being, in the mowing machine, fixed from 10 to 15 cm higher, the rear curve of the swanneck is made from 10 to 15 cm shorter.

With this fore-carriage, turns of 90° may be made both right and left, and the machine may be backed if desired. The fore-carriage can never upset, because the point of attachment *a* lies very low. The front axle is also able to describe an angle of more than 45° horizontal relatively to the rear axle.

1006 – **Apparatus for Extracting the Oil from Oily Substances by means of Non-inflammable Solvents.** — CIAPETTI GINO, in *L'Italia agricola*, 53rd year, No. 7, pp. 298-300, 1 fig. Piacenza, July 15, 1916.

The small open-fire apparatus represented on the appended figure admits the economical extraction of the oil of oily fruits and seeds and their residues (lees and cakes), even on the smallest farms, by means of solvents




Apparatus for extracting oil from oily substances by the aid of non-inflammable solvents.

which are non-inflammable and non-explosive, and also harmless and pleasant in smell, such as carbon tetrachloride and ethylene trichloride.

These two liquids, insoluble in water, dissolve fats in a larger proportion than benzine and carbon bisulphide, while possessing the advantage over the latter that they require less heat and less water for the process of evaporation and condensation. Although carbon tetrachloride is dearer than carbon bisulphide, it is nevertheless cheaper to use, owing to the fact

that it undergoes far smaller losses during the process of extraction, which, in addition is carried much farther : while carbon bisulphide leaves up to 4.5 % of oil unextracted, with the use of the tetrachloride this loss does not exceed 1.6 %. Finally this solvent very readily gives up the oil extracted (with which it does not form an emulsion as does carbon bisulphide) and, if the seeds or other oily substances to be treated are not deteriorated, an oil as good as if extracted by pressure is obtained.

The essential part of the apparatus in question is an extractor *A* in which a metal gauze basket is suspended containing the oily matters to be subjected to extraction, broken up to allow of easy access to the solvent. The latter circulates from below upwards by means of the leaching-tube *O*, and thus effects the extraction of the oil in the form of a solution which gathers at the bottom of the extractor. The vapour of the solvent, rises through the pipe *H*, and is then conducted through the pipe *M* to *B*, where it condenses in a coil cooled with running water. By using the tap *P*, the condensed solvent may be made to return to the extractor, or through the pipe *I* it way be made to pass into the tank *C*.

When the extraction is completed, the extractor (placed on a furnace) is heated either with an open fire, or in a water bath in the case of delicate oils. In this way the bulk of the solvent is eliminated from the oil solution collected at the bottom, and afterwards, in order to remove the last traces, hot air is injected into the extractor by means of a small force pump. When this is done, the oil can be drained off by opening the tap R.

The waste heat of the furnace is used to heat the drier D, where the broken up oily material is kept for some time before extraction.

The apparatus being airtight the losses of solvent are very small.

To accelerate the work and make it continuous, the apparatus is made with 2 extractors, one of which is in operation while the other discharges and recharges for the next operation.

The appliance is easily managed, and does not require more than 2 workmen.

1007 - **Appliance for Burning Tree Stumps *in situ*.** — *Scientific American*, Vol. CXIV, No. 25, p. 643, 1 fig. New York, June 17, 1916.

This appliance, which is termed a " stump-burner ", being a sort of portable stove for charring and destroying wood, was recently tried with success by a large forest working company in Mississipi (United States).

It is placed on a stump, and the latter subjected to slow combustion until completely charred, during which time the heavy oils (heavy products of dry distillation) are collected. When these operations have been completed on one stump, they are repeated on another, by carrying the apparatus to it, and so forth.

This contrivance is capable of rendering great service on cleared forest land to be brought under cultivation, as it greatly facilitates clearance, which the laborious rooting up of the stumps by ordinary means generally makes so expensive ; it destroys the stumps to a sufficient depth to allow of ploughing without needing to cut roots or carry out any preparatory soil

work. At the same time this process is advantageous from the economic point of view (provided the stumps are thoroughly dry) as it yields products the value of which may entirely cover the costs of extirpation. Thus, an ordinary pine stump gave, in addition to excellent quality charcoal, about 15 gallons of heavy oils.



Battery of Tree-stump burners in operation.

### 1008 — Review of Patents.

*Tillage.*

Germany

286 313. Subsoil plough.
286 314. Gripper wheel for motor ploughs.
286 315. Horse hoe.
286 316. Return mechanism for cable-hauled ploughs.
286 317 — 287 810. Arrangement for ploughing, with 1 portable engine, driving by cable 2 ploughs with return mechanism, between which it is set up.
286 318. Motor plough with rear supporting wheel running on the unploughed land.
287 081. Furrow or ditch digger, especially for plantation.
287 082. Motor plough with driving gear for the steering wheels.
287 100. Regulating and clearing mechanism for plough wheels.
287 130. Rotary screw digger.
287 445. Ploughing machine with adjustable frame carrying plough shares and coulters.
287 484. Drill with several rows of teeth.
287 573. Field harrow capable of use as a grassland leveller.
287 811. Method of fixing plough bodies.
288 015. Rigid frame hoe carrying the working parts and jointed to the shaft support.
288 569. Arrangement to prevent side displacements of the beam in wheel ploughs.
288 845. A sprung plough body.

288 846. Tillage machine driven by motor and impelled by the alternate action of shovels digging into the ground.
288 882. Method of fixing harrow teeth.
288 883. Drill acting as a borer in the soil (1).
289 482. Antibalance mechanism for tipping ploughs.
289 536. Carriage wheel for motor-driven ploughs and other tillage machines.
289 558. Portability device for wheel ploughs.

Switzerland 73 030. Tilling machine.

United Kingdom 3 517. Subsoil plough.

United States 1 183 309 — 1 185 590. Plough regulators.
1 184 707. Horse hoe.
1 184 832. 2-row maize cultivator.
1 184 900. Double-breasted plough.
1 184 754 — 1 184 768 — 1 186 130. Harrows.
1 185 238. Device for raising and lowering harrows.
1 185 324. Subsoil plough.
1 185 325 — 1 185 504. Ploughs.
1 185 857. Plough disc.
1 185 923 — 1 186 515. Wheel ploughs.
1 186 355. Weeder.
1 186 365. Leveller for ploughed land.
1 186 441. Disc plough.

*Draining and Irrigation.*

Germany 287 809. Device for drying peat beds, marshes, etc.
289 474. Automatic pond-emptying arrangement for irrigation.
289 821. Drains.

*Manure Distribution.*

Germany 288 324. Liquid manure barrel with distributor.
288 350. Appliance for dissolving nutritive salts in irrigation water.
289 973. Manure spreader.

United States 1 185 133. Manure spreader.

*Sowing and Planting.*

Germany 286 694. Elevator for uniformly distributing bodies of different sizes particularly for potato planters.
287 336 — 289 887 — 289 921. Potato planters.
288 042. Drill for sowing at variable depths.
288 070. Drill with wheel for dibbling plants.

*Cultivation.*

Canada 168 186. Glass-house.

Germany 287 063. Automatic arrangement for watering flower beds.
287 069. Glass-house window with wooden sash having grooves in which the glass panes may be inserted.
287 203. Nozzle for garden watering hose.
288 932. Arrangement for heating the ground by tubes placed therein.

(1) See *B.* February 1916, No. 217. (*Ed.*)

289 787. Detachable cement frame for hot beds.
289 788. Arrangement for lopping branches by means of a circular saw fitted at the end of a rod and driven by a pulley with cord.
289 805. Arrangement for regulating the spead of rotation of watering appliances.
289 954. Sash for beds with arrangement by which several at a time may be opened or closed.

Spain 62 202. Vine sulphurator.

United Kingdom 3 908. Compressed air sprayer.
4 473. Sprayer.

*Control of Pests.*

France 480 015. Enclosure for catching rabbits, rats and other small animals.

Germany 287 772. Animal trap.
288 118. Method of destroying insect crop or house pests, and preserving clothing, furs, etc. from injury by them.
288 422. Fly trap with clockwork movement.
288 538. Wild animal trap.
289 330. Ditch arrangement for protecting crops against injurious animals, particularly weevils.
289 462. Fly and gnat trap.

United Kingdom 4 025. Trap.

*Harvesting Forage, Cereals, etc.*

Germany 286 625. Harvesting machine with 2 cutting bars, one mowing flush with the ground, the other located behind and above the first.
287 186. Scythe hammering machine.
288 832. Scythe hammering machine with revolving anvil.
288 884. Rake drum for binders, revolving as soon as a rake has got together a given number of straws.
289 786. Scythe and sickle hammering machine.
289 953. Locking device for the bolt screws used to fasten the teeth of cutting bars on mowing machines.

Netherlands 1 407. Hay-maker.

United Kingdom 3 480. Machine for mowing rice, papyrus and other aquatic plants.

United States 1 184 794. Maize harvester.
1 185 243. Mowing machine.
1 185 430 — 1 185 593. Horse-drawn hay rake.

*Root and Tuber Crops.*

France 478 964. Appliance for aligning beet and other machine-harvested root crops.

Germany 286 275. Machine for lifting beets from 2 rows at once, with 2 adjustable mould boards fixed to a share.
287 337. Machine for lifting beets.
287 418. Machine for lifting potatoes, with loose chains adapting themselves to uneven ground.
287 446. Machine for topping beetroots on several rows at a time.
287 710. Thrower wheel with forward driven forks for potato machines.
288 253. Beet harvester with mechanism for throwing the beets.
288 254. Sorting drum for potato lifting machine, consisting of 2 drums with different meshes engaging in each other.

United States 1 185 540. Potato, earthnut, etc. harvester.
1 185 785. Beetroot harvesting machine.

*Threshing, cleaning and sorting Grains and Seeds.*

Germany 287 131. Automatic thresher feed with arrangement for cutting the binder string.
287 537. Shaker for grain sorting.
288 479. Appliance for sorting coffee, dried leguminosae and other seeds.
289 458. Sorting cylinder with lining made of metal rings or spirally wound metal wire.
289 559. Fan for threshing machines.
Spain 61 942. Thresher.
United States 1 185 957. Thresher.

*Conveyance, handling and preservation of crops.*

Canada 158 058. Protective guard for fruit baskets.
158 091. Apple sorter.
168 152. Silo.
168 358. Exterior arrangement for holding together the planks forming a silo.
168 484. Guard device for banana bunches.
Germany 287 083. Coupling for forage cutters.
287 101. Straw-press.
287 102. Straw-press for hand binding.
288 174. Potato, apple, etc., peeling machine.
288 351. Trellis-work support for strawberries and the like.
289 315. Chopping machine with sifting arrangement.
289 316. Arrangement for cleaning gooseberries and removing their stalks.
289 457. Mechanism for parallel direction of the feed cylinders of forage-cutters.
289 459. Forage cutters.
289 460. Press for cut forage, chop and the like.
289 461. Chaff cutter with bent plate having convex cutting edge and plate for compressing the straw (1).
289 922. Straw press with oblique compression channel and needle entering from below.
Spain 61 999. Straw and hay elevator.
Switzerland 77 909. Cart for hay and cereals.
United States 1 185 155. Forage cutter.
1 185 457. Appliance for compressing grass in silos.
1 185 777. Straw cart.
1 185 845. Forage press.
1 186 302. Machine for chopping forage for ensilage.
1 186 505. Machine for making straw stacks.

*Livestock Feeding.*

Germany 289 923. Multiple feed apparatus with food storage tank.
United Kingdom 4 134. Trough.

*Industries depending on vegetable products.*

Portugal 9 782. Appliance for improving wines with high alcoholic content.

(1) See *B.* April 1916, No. 429. (*Ed.*)

| | | |
|---|---|---|
| Spain | 62 035. | New system of ferro-concrete receptacles for wines. |
| | 62 166. | Appliance for extracting vegetable oils, particularly from olives. |
| United Kingdom | 3 651. | Bottle-washing machine. |
| | 3 699. | Method of extracting the albumen from the residues of various vegetable oils. |
| | 3 854. | Method of filtration of cane juice. |
| | 4 066 | Bottle filling and capping machine. |

*Dairy Industry.*

| | | |
|---|---|---|
| Canada | 168 502. | Churn. |
| Germany | 288 352. | Milk cooling and aerating machine. |
| | 288 714. | Centrifuge for milk and other fatty liquids. |
| | 288 715. | Centrifugal drum with false bottom for discharging skim milk. |
| | 289 442. | Suction milking machine. |
| | 289 537. | Safety device for centrifugal machines for milk and other fatty liquids. |
| | 289 560. | Churn with turbine-driven beater. |
| United Kingdom | 3 782. | Skimmer. |

*Steering and hauling agricultural machines.*

| | | |
|---|---|---|
| Germany | 287 067. | Steering mchanism for agricultural machines with front wheels mounted on pivoting axle arms. |
| | 287 980. | Tractor for tillage machines. |
| | 288 255. | Coupling a train of agricultural machines with a tractor. |
| United States | 1 168 340. | Tractor. |

*Miscellaneous.*

| | | |
|---|---|---|
| Germany | 286 805. | Calk keys for horse shoes. |
| | 287 847. | Wickerwork for fences. |
| | 288 421 — 288 480. | Arrangements for untying cattle in the byre. |
| | 288 738. | Incubator with arrangement for heating and moistening the air introduced. |
| | 289 055. | Eel catcher. |
| | 289 329. | Horse-shoe with non-slipping fitting. |
| | 289 757. | Dog-training device. |

FARM BUILDINGS.

1009 – **Automatic Watering of Dairy Cows** (1). — RINGELMANN MAX, in *Journal d'Agriculture pratique*, Vol. 29, No. 13, pp. 226-227, 4 fig. Paris, June 29, 1916.

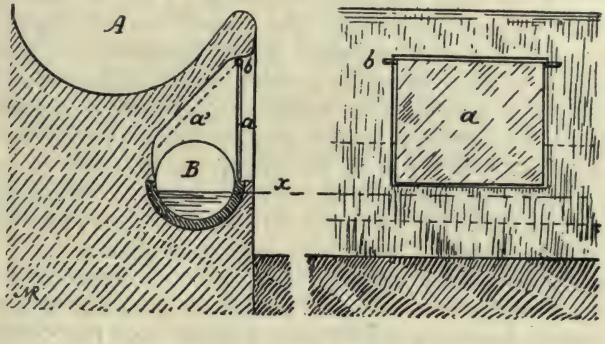
A simple and inexpensive system of watering cattle consists in providing beneath the manger *A* (fig. 1) a canal *B* in which the water is maintained at a constant level *x*. To the right of the place of each animal, a mounting is fitted in the manger which can carry a shutter *a*, hinged on 2 pivots *b*, and which the cow pushes to *a'* in order to drink at *B*. The shutter measures 24 to 30 cm in width, and 20 to 25 cm in height.

Instead of using this patent system it is sufficient to place at every second stall a small trough *A* (fig. 2) made of cast iron, stone or cement; in which a pipe *a*, connected to the main *b*, would ensure a standard level of water *x*. To avoid injury, the main *b* may be accommodated in a groove cut on the outer wall *y* of the crib *c*. The stone or cement trough may be

(1) See *B.* 1914, No. 275. (*Ed.*)

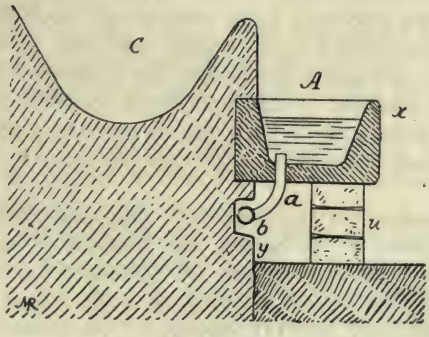
supported by a small wall *u*. The cast iron trough is fixed by lugs by means of running bolts or wood screws, according as the wall to which it is attached is made of brickwork or wood.

Fig. 1.—*Watering arrangement beneath manger.*




Cross section Longitudinal view

Fig. 2.—*Watering arrangement in front of manger.*




Cross section.

## RURAL ECONOMICS.

1010– **Results of Farm Management Demonstration Work in U. S. A.** — GODDARD L. H., in *Proceedings of the Sixth Annual Meeting of the American Farm Management Association, Berkeley Cal.* 9-10 August 1915, pp. 26-33. Washington, 1916.

The bill which authorised the establishment of the Bureau for Economic Improvement of Farms in the United States Department of Agriculture was passed on the 13th July 1914. The report of the 1st July 1915 shows that the work has been started in 21 States, and that during the period of organisation in the first year, considerable work was done and noteworthy progress achieved.

The work of demonstration was carried out in 105 different zones lying in the 21 States in question in the territory of which the Bureau has up to now been instituted, and comprises the economic study of 8 032 farms. For 5 009 of them the compilation of analytic data serving to bring out clearly in the form of " Farm Analysis Records " the organisation and economic results of the farm has been completed ; 1 952 of these records were returned to the farmers concerned, after careful critical study on the part of the officials who had prepared them (farm compilators). The discussion which took place in this connection concerning the organisation of the farm and desirability of its modification resulted in 542 farmers approving and beginning to carry out certain proposed changes, and 1 439 farmers adopting a system of accounts which will in the future enable them to supply more accurate particulars for the analysis record. Other farmers, to the number of 876, applied for farm demonstrators to make a second visit to their farms in order to obtain advice in connection with reorganisation.

The considerable work accomplished since the outset *i. e.* during the period of organisation, is largely due to the co-operation of the Farm Bureaus and County Agents in the different counties and the Superior Schools of Agriculture. The chief object of the federal farm economics improvement demonstration Bureau is to guide the county agents in this examination of the organisation of farms in their region, in order to come directly to the aid of the farmer who may have adopted an organisation which cannot yield him the normal reward far his labour, and who nevertheless maintains this system. They will point out to him the difference between the results of the organisation adopted by him and those normally obtained in the belt where he operates, and between such results and those secured by more skilful and smart farmers who manage to get the largest possible reward for their labour.

This Farm Economics Improvement Demonstration Bureau has been successfully established in 21 States, and has above all rendered evident the fact that in each region the economic results of the farms varies within wide limits. From the figures relating to 4 400 farms hitherto compiled it is ascertained that the general average of the reward of labour of the farmer was about $ 400. If progressively organised farms are divided into 5 groups of 880 farms each, the 1st group, which represents the highest reward for the farmer's labour, has an average of about $ 1 500; the 2nd group, about $ 700 ; the 3rd about $ 350 ; the 4th about $ 100 and for the 5th the loss is about $ 600.

Thus, $^1/_5$ of the farms not only yield no reward for the manual labour or management of the farmer, but in addition leave a deficit of $ 600 each on an average on the return on the capital reckoned at 5 % and the reward for the labour carried out by the members of the farmer's family.

The Farm Economics Improvement Demonstration Bureau is intended chiefly to come to the assistance of this last class of farmers, by pointing out to them the standard organisations in the zone where they operate, as well as those of farmers securing the best reward for labour.

The appended Table shows by way of example the method of com-

parison of the farm analysis records adopted in criticising the farms of lowest return.

In view of the importance of maize-growing in the region in question, farm *B* shows that it has a unit production superior to the average of the region, and an index of realisation of the products of livestock much higher than the average, and better than that of the most paying farms. The low reward to the farmer, below the average, is exclusively due to the insufficient area of the farm as compared with the unit of labour of the men and horses used. The owner of the farm *A*, who possessed a smaller farm than *B*, rented an area of land which enabled him to get rid of this disadvantageous factor, considering that the normal farm in the region covers about 130 acres. He thus secured a high reward for his labour, in spite of the low efficiency of the conversion of feeds by his cattle. From a study of the various organisations as compared with the standard organisation represented by the average of a large number of farms (50 to 100) for each zone studied, practical indications are drawn for farm organisation considerably reducing the practical apprenticeship of farmers, and laying the rational bases for farm organisation in each agricultural region.

From the experience gained during the first period of organisation of this important demonstration Bureau, the following conclusions are drawn:

1) In each region some farmers obtain results much in excess of the average from their farm.

2) These farms paying better than the others are not easy to distinguish by mere external examination, on the basis of the more or less good condition, the more or less high quality of the livestock, or the total of the cash receipts.

3) The only reliable method for comparing the economic result obtained by a farmer with that of other farmers in a particular region consists in comparing the respective labour incomes (1).

4) For the majority of farmers who wish to improve the economic results of their farms it is extremely useful to determine the labour reward of the farmer, and if it is too low, to analyse the organisation of their farms in its various component parts, and afterwards to compare the data thus isolated with those of other farmers working under like conditions.

5) It is comparatively easy to make a brief analysis record of organisation, to calculate the farmer's labour income, and then to pass on to a critical comparison of these data on other farms, in order to determine the necessary changes in such organisation.

6) Farmers generally are very favourable to this work of demonstrative research, provided the work is put to them in the proper way and at the right moment.

7) County agricultural agents and the teaching staff of schools

(1) The labour of the farmer is calculated by deducting from the gross proceeds the expenses and capital interest at 5 %. The expenses include the labour performed by members of the farmer's family, reckoned according to equivalent wages for hired labour. On the other hand the farm products consumed by the farmer's family do not appear. (*Ed.*)

*Comparison between Farms in the County of Iowa.*

| | Farm *A* | Average of 13 best farms | Average of 62 farms | Farm *B* |
|---|---|---|---|---|
| Farmer's labour income | $ 1 231 | $ 1,050 | $ 145 | $ 72 |
| *Size of farm:* | | | | |
| Total area | 282 acres | 188 acres | 171 acres | 100 acres |
| Cultivated area | 234 | 144 | 125 | 70 |
| Livestock units | 18 | 24 | 21 | 12 |
| Total receipts | $ 3 393 | $ 3 211 | $ 2 430 | $ 1 597 |
| *Quality of Business:* | | | | |
| Livestock: Returns on $100 of feeds consumed | $ 102 | $ 130 | $ 119 | $ 169 |
| *Crop yields:* | | | | |
| Maize . . . bushels per acre | 50 | 43 | 38 | 40 |
| Oats . . . » » » | 37 | 40 | 37 | 37 |
| Hay . . . tons | 1.3 | 1.6 | 1.6 | 1 |
| *Efficiency of labour:* | | | | |
| Crop acres per man | 102 | 85 | 75 | 59 |
| Crop acres per horse | 37 | 22 | 18 | 12 |
| *Diversity of business:* | | | | |
| Principal receipts: | | | | |
| Maize | $ 680 | $ 813 | $ 615 | $ 360 |
| Oats | 584 | 304 | 240 | — |
| Pig breeding | 843 | 868 | 685 | 680 |
| Cattle breeding | 556 | 536 | 359 | 355 |

of agriculture well trained by a farm management demonstrator speedily become capable of rapidly ascertaining the reward of the farmer's labour, and making the comparative examination of organisation of different farms. This special competency of the persons who are at the heads of local agricultural interests in this branch of rural economics forms the first direct object towards which the organisation of this Federal Bureau tends.

8) Many farmers easily succeed in computing themselves the reward of their labour, and analysing their farm, under the guidance of the local farm Bureau, and this is the final object aimed at by the central Government in establishing this Institution.

9) The Farm Economics Improvement Bureau is furthermore highly useful to the county agricultural agents and these whose duty it is to watch over local interests, as it affords them the means to getting a better knowledge of the real agricultural conditions of their region, and the problems

which farmers are called upon to meet, by bringing them into touch with the farmers in a form very promising as regards agricultural progress.

1011 – **Crop Yields and Prices and Future Food Supply in the United States.** — WARREN G. F., in *Cornell University, Agricultural Experiment Station of the College of Agriculture. Department of Farm Management*, Bulletin 341, pp. 185-212. Ithaca, N. Y., February 1914.

From an examination of the unit production of the principal agricultural products in the United States from 1879 to 1912 and their prices from 1840 to 1912, the writer derives the following conclusions, which present general interest from the point of view of the future direction to be taken by production.

The gross prices of agricultural produce from 1905 to 1912 are found to be slightly above those of the average for the last 73 years, as shown by the following table :

| | | | Average for 73 years | Average 1915-1912 |
|---|---|---|---|---|
| Maize | (New York) | per bushel | $ 0.66 | $ 0.66 |
| Winter wheat | (New York) | per bushel | 1.25 | 1.04 |
| Cotton | (New York) | per pound | 0.154 | 0.118 |
| Potatoes | | per bushel | 0.65 | 0.62 |
| Oats. | (New York) | per bushel | 0.45 | 0.47 |
| Pigs | | per bushel | 5.71 | 6.78 |
| Cattle | | per bushel | 5.74 | 6.37 |
| Sheep | | per bushel | 4.00 | 4.29 |
| Butter | | per pound | 0.244 | 0.262 |
| Eggs | | per dozen. | 0.226 | 0.287 |

The prices obtained by farmers for animal products are seen to be above the average, but those of crops are nearly equal to or below the average for the last 73 years. During an entire generation, in the period of settlement of the great prairies in the West of the United States, the prices were very low, so that in comparison with this period the present prices are no doubt high, but very little exceed the general average for the long period in question. During the last 10-15 years the unit production in East Mississippi has increased rapidly, while before that, especially towards 1890, there was a period of low yields and abandonment of the countryside by young men, due to the excessively low price of products.

Farmers, generally speaking always succeed in increasing the unit production as soon as the prices of products are barely sufficient to justify the increased expense required to obtain an increase in production. In each county of the United States there are still considerable areas of land which might be brought under cultivation by clearance, drainage, irrigation, etc., but the extensions enabling the production to be increased without increasing the cost prices are henceforward very limited. The lands to be cleared, drained, irrigated or heavily manured are expensive lands and their products will consequently be dear. When once an average unit production is attained, every bushel of production obtainable above this average generally costs more than the previous one. The limit of produc-

tion per unit of surface in the United States is far from being attained, but the phase of production at cheap cost price has been passed.

The farmers rapidly adapt their production to the price of products, and if the present prices are maintained the production will increase, and if they go up still further the production may grow considerably.

There is apparently no likelihood of the prices paid to farmers for their products showing a permanent decline. There are some means, however, by which the price of products to the consumers may be reduced The present mechanism of the distribution of agricultural products to consumers is exceedingly expensive in the United States, and a great part of the expenses entailed might be eliminated. A sum ranging from 50 to 66 % of the price paid by the consumer does not reach the producer, and the greater portion of this percentage is absorbed by the town distributing mechanism. It is estimated that one-half of these expenses could be eliminated ; such a saving in distribution would of course entail a change of occupation of a large part of the persons occupied in the present system.

Necessarily, in proportion as the population increases, the consumption of the less expensive commodities also increases, and beef is one of the most expensive agricultural products, because in order to obtain it a considerable quantity of cultivation products must be converted. It has been calculated that a given quantity of cereals can feed a number of persons five times greater than the meat obtainable by transformation of these cereals. With the increase of population, the price of cereals goes up more rapidly than that of meat. A given quantity of products converted into milk produces a larger quantity of commodities intended for human consumption than would the same quantities converted into meat ; consequently the number of dairy cows increases almost parallel with the growth of the population. The United States possess one cow to five head of inhabitants. In addition to the milk, this quantity of dairy cattle yearly supplies a calf, a cow and a bull to the butcher for each family.

Pigs convert the food intended for animal consumption more economically than beef cattle, and with the same quantity of cereals a higher proportion of meat is obtained with pigs than with cattle. This explains the increase in the number of pigs and the reduction in the number of beef cattle. Poultry, finally, convert foods still more economically than other classes of domestic animals. The substitution of eggs for beef is observed chiefly in those parts where the greatest increases of population occur. From 1890 to 1910 the increase of the population in the 7 principal egg-consuming markets (New York, Chicago, Boston, Saint Louis, Cincinnatti, San Francisco and Milwaukee) was 78 % and the increased egg consumption amounted to 183 %. When the population becomes very dense, the forage produced on farms is converted into milk, and the meat production is limited to the quantity obtainable from the forage and grasslands still available when the former demand has been met. The quantity of cereals transformed by means of cattle diminishes constantly. This state of things finds its confirmation in the progressive reduction of fattening cattle and in the tendency to kill off young animals for the butcher.

All these modifications in the direction of production prove that the quantity of meat available per inhabitant is diminishing, and that unfortunately the classes who must renounce a large meat consumption are those engaged in manual labour, that is, the very classes who most feel the need for meat food. All this finally proves that the United States are also experiencing the first symptoms of the state of things always observeable in densely populated countries. Though it is likely that in the future the United States will be able to feed the numerous population which is to be anticipated, it is certain on the other hand that the future popullation will not be able to live so well as does the present.

The writer sees in the localisation of manufacturing industry in rural districts the possibility of considerably reducing the cost of living, while allowing the workman's family to have a garden or even a small farm which can furnish vegetables and poultry, together with a sufficient quantity of forage to keep a dairy cow. He nevertheless criticises the opinion maintained by many persons that in order to reduce the cost of agricultural products it would be necessary to break up farms and reduce their size, because nothing but disadvantage to consumers can result from the fact that a greater portion of the products is consumed by a larger number of producers and labour animals employed per unit of area.

In the general farming region, from the State of New York to Nebraska, the tendency in reality is to pass from a farm with two pairs of horses *i. e.* from 80 to 100 acres to one with three pairs, *i. e.* from 120 to 150 acres, owing to the fact that by working smaller areas the horses which are indispensable to haul modern labour-saving machinery are not completely utilised, and consume an excessive proportion of the gross product.

Farms specialising in market-gardening and fruit production may be smaller, but to meet the demand for these products a very small number of farms is required as compared with those needed to meet the demand for cereals, forage, potatoes, livestock and derived products; for this class of production the medium sized farm, as will be seen, supplies the consumer with a quantity of products per unit of surface greater than that furnished by the farm of smaller area. China, the classical country of the very small farmer, really exhibits a picture of an agricultural population which, in spite of the assiduous labour of men, women and children, scarcely succeeds in producing a little more than what it consumes to live, and which is only able to maintain a small percentage of consumers in towns. The low price of labour is the index to the poverty of this population. As long as the high price of labour continues in the United States, so long will the use of machinery and farm horses be required for growing the principal agricultural products, and this will entail such size of farm as may be adapted to the best utilisation of such machines and horses.

The Author strongly recommends the restriction of immigration by increased severity in the regulations for the admission of emigrants, as forming one of the best means to prevent the cost of living continuing to rise more and more, and putting a stop to the present tendency to lower the standard of living now obtaining.

Furthermore, considering the extraordinary needs for phosphorus for vast tracts of land in the United States, the writer thinks that the time has arrived to make a careful estimate of the stores of phosphates in the United States, and if need be, to restrict their export.

1012 - **Time and Method of Tillage on the Yield and Comparative Cost of Production of Wheat in the Pelouse Region of Eastern Washington.** — THORN C. C. and HOLTZ H. F., in *State College of Washington Agricultural Experiment Station, Bulletin* No. 123, Pullman, Wash., July 1915.

The data summed up in the appended Table result from a series of comparative tests of cultural systems with biennial rotation and systems of tillage of the soil, for wheat growing in the region of Pelouse, in the east of the State of Washington, U. S. A. These trials were carried out in such a way as to eliminate as far as possible the influence of factors other than those inherent in the different methods of soil tillage, both as regards the time and mode of carrying them out.

| System of cultivation | Yield in bushels per acre | Gross returns per acre | Cost per acre | Net returns per acre |
|---|---|---|---|---|
| I. Maize and wheat alternating, with annual autumn ploughing. . . . . | maize 30.0<br>wheat 37.8 | $ 56.24 | $ 13.65 | $ 42.59 |
| II. Alternate peas and wheat, with annual autumn ploughing . . . . . | peas 32.0<br>wheat 33.7 | 52.56 | 17.35 | 35.21 |
| III. Wheat and summer fallow, with autumn ploughing after wheat . . . | wheat 49.4 | 39.50 | 10.05 | 29.45 |
| IV. Wheat and summer fallow, early spring ploughing (April 3) and rolling | wheat 49.0 | 39.20 | 10.55 | 28.65 |
| V. Summer wheat and fallow; early spring ploughing (April 3) without rolling . | wheat 51.7 | 41.36 | 10.35 | 31,01 |
| VI. Summer wheat and pasturage, with autumn ploughiug after pasturage. . | wheat 20.2 | 17.16 | 6.15 | 11.01 |
| VII. Summer wheat and fallow, with late spring ploughing (June 10) and rolling . . . . . | wheat 38.5 | 31.00 | 8.80 | 22.20 |
| VIII. Summer wheat and fallow; late spring ploughing (June 10) without rolling . . . . . | wheat 36.6 | 29.28 | 8,05 | 21.23 |
| IX. Summer wheat and fallow; early spring disking (April 3), late spring ploughing (Junè 10), rolling. . . . . | wheat 42.4 | 33.92 | 9.70 | 24.22 |
| X. Summer wheat and fallow; antumn harrowing, late spring ploughing (June 10), rolling . . . . . | wheat 37.3 | 29.84 | 9.20 | 20.64 |
| XI. Summer wheat and fallow; autumn ploughing, late spring harrowing (June 10) . . . . . | wheat 49.7 | 39.76 | 9.45 | 30.31 |

The analytic calculation of the expenses was made according to the following actual unit costs (per acre):

| | | | |
|---|---|---|---|
| Ploughing | $ 1.50 | Binding and shocking wheat | $ 1.35 |
| Disking | 0.50 | Cultivating maize | 0.50 |
| Harrowing | 0.20 | Maize harvesting | 2.00 |
| Rolling | 0.50 | Pea harvesting | 2.00 |
| Sowing | 0.40 | Threshing | 0.10 per bushel |

The cost of cultivation calculated in this way is only aimed at bringing out clearly the relative value of the different systems in reference to the biennial rotation used, and making a fresh contribution to working economics as regards the wheat growing in the region where the comparative trials were conducted.

1013 – **Enquiry into the most usual Depreciation Rates for Agricultural Machinery in Minnesota, United States.** — *Farm Implement News*, Vol. XXXVII, No. 22, p. 18. Chicago, June 1, 1916.

The Farm Economics Bureau of the Minnesota College of Agriculture has published the results of the enquiries carried out on 24 farms in the State of Minnesota, for determination of the rate of depreciation of the principal agricultural machines.

The figures of Table I represent the average for the 24 farms studied, and the observations are based on the use of the machines in question during 10 years.

TABLE I.

| Name of Machines | Annual rate of depreciation |
|---|---|
| Grain binders | 6.54 % |
| Grain drills and seeders | 5.06 |
| Maize binders | 7.97 |
| Maize planters | 6.41 |
| Maize cultivators | 6.23 |
| Mowers | 6.80 |
| Hay tedders | 4.21 |
| Hay loaders | 7.37 |
| Rakes | 6.30 |
| Gang ploughs | 6.41 |
| Sulky ploughs | 8.34 |
| Walking ploughs | 5.85 |
| Waggons | 3.89 |
| Harrows | 5.88 |
| Discs | 5.29 |
| Manure spreaders | 10.37 |
| Hay elevators | 8.54 |
| Reapers | 9.27 |
| Silage cutters | 7.43 |
| Cream separators | 7.93 |
| Fanning mills | 3.74 |

These rates of depreciation are based on an extensive use of the machines, as is apparent from the low unit rate per acre obtained on taking into account the area annually tilled (see Table II).

TABLE II.

| Machinery | Average value consumed annually per acre |
|---|---|
| *For cereals*: | |
| Binders | $ 0.168 |
| Drills | .072 |
| Fanning mills | .014 |
| Waggons, sleds and racks | .077 |
| *For maize*: | |
| Reapers and binders | .604 |
| Cultivators | .223 |
| Planters | .083 |
| Silage cutters | 1.216 |
| Waggons, etc. | .195 |
| *For hay*: | |
| Mowers | .167 |
| Rakes | .079 |
| Forks, slings etc. | .046 |
| Loaders | .095 |
| Tedders | .062 |
| Waggons, etc. | .155 |
| *For cultivation generally*: | |
| Ploughs | .095 |
| Harrows | .019 |
| Disc pulverisers | .037 |
| Manure spreaders | .337 |

1014 – **Profit ensured in Southern Rhodesia by Treating Potatoes with Bordeaux Mixture.** — JACK RUPERT W., in *The Rhodesia Agricultural Journal*, Vol. XIII, No. 3 pp. 354-360, Pl. I-II. Salisbury, Rhodesia, June 1916.

The writer proposed to ascertain whether, from the financial point of view, there was any advantage in treating potatoes with Bordeaux mixture for control of the disease known as " early blight " caused by *Alternaria Solani*.

The experiments, which were continued for three years, dealt with the " Up-to-date " variety, the chief one grown in the region under examination, and also one of the most resistant to the disease. In the experiments, every second row of potatoes was treated and the intermediate row left for control of the results. In this way, the errors due to the differences of fertility in the other plots and those produced by irregularity in the spread of the disease were avoided. Furthermore, the rows treated were nevertheless exposed to infection from the untreated neighbouring rows, while in the latter, the risks of infection by the passage of spores from one plant to another were reduced by the presence of treated rows.

In short, the conditions were such that they tended to reduce the differences of yield due to the treatment between the treated and the untreated lines.

TABLE I. — *Increase of yield due to spraying.*

| Number of days between 2 successive sprayings | Number of sprayings | Total yield | | | Table potatoes | | | Seed potatoes | | | Marketable potatoes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Treated lbs. | Untreated lbs. | Percentage of increase | Treated lbs. | Untreated lbs. | Percentage of increase | Treated lbs. | Untreated lbs. | Percentage of increase | percentage of increase |
| 7 | 7 | 104 | 77 | 53 | 38 | 16 | 137 | 41 | 26 | 57 | 88 |
| 14 | 4 | 87 | 59 | 30 | 15 | 10 | 50 | 41 | 28 | 46 | 47 |
| 21 | 3 | 87 | 77 | 16 | 19 | 15 | 26 | 48 | 42 | 14 | 17 |

TABLE II. — *Estimate of profit due to spraying.*

| Number days between 2 sprayings | Number of sprayings | Marketable tubers increase per acre lbs. | Value, at 3/4 d. per lb. | Cost of spraying at 10/— per acre | Net profit per acre from spraying |
|---|---|---|---|---|---|
| | | | £ s. d. | £ s. d. | £ s. d. |
| 7 | 7 | 3 772 | 11.15.0 | 3.10.0 | 8. 5.0 |
| 14 | 4 | 1 836 | 5.15.0 | 2. 0.0 | 3.15.0 |
| 21 | 3 | 1 020 | 5. 4.0 | 1.10.0 | 1.14.0 |

In spite of this the differences were considerable, as will be seen from the appended tables, the first of which gives the increase of yield due to the treatment, and the second the profit secured by the operation. The treatment was carried out with a Bordeaux mixture consisting of 4 lbs of copper sulphate and 4 lbs of fresh lime per 40 gallons of water. The rows were 2 feet 6 inches apart, and the plants 15 inches apart in the rows.

## AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

1015 – **Conditions under which the Cold Storage Industry will Render the greatest Services to the Vine-Growing Industry in Tunisia.** — RAY GEORGES, in *Le Froid*, 4th Year, Vol. IV, No. 1, pp. 19-34, diagrams 5. Paris, January-June 1916.

The writer points to the special interest presented by the application of cooling methods in wine growing in Tunis, where, owing to very high

temperatures, the alcoholic fermentation of the musts may be either disastrously shortened or dangerously prolonged as the case may be.

*The Question of Musts.* — In normal years, the methods of control usually employed in Tunisian wine cellars to obviate an excessive rise of temperature in the vats give satisfactory results, if care is taken to work on normal musts properly corrected with regard to the due proportions of their elements, especially in respect to acidity and saccharine content. The usual means of prevention consist in :

1) Cooling the grapes as a prior precaution during the night, leaving them outside in pans or boxes, after sometimes sprinkling them with water ; 2) using small vats, in which the losses of heat by radiation are proportionally larger than in the large ones ; 3) raising of the must, with or without aeration ; 4) drawing off must, that is to say racking, as soon as the temperature in the vats reaches the dangerous point (35-37°C) ; 5) using metallic vats in order to increase the loss of heat by radiation ; 6) using cooling agents ; unfortunately the water for feeding these cooling agents is insufficient and lukewarm ; 7) using antiseptics, the mutage being effected with sulphyrous anhydride, on condition that not more than 450 mmg. of sulphurous acid per litre (of which 100 mmg. in the free state) remains in the wine ; 8) using local yeasts acclimatised to sulphurous anhydride ; 9) utilising several of the above mentioned methods of prevention together.

In hot years, as for instance 1913, these methods are often impotent to moderate the irregular course of fermentation. The following two examples are given : 1) the first relates to a highly concentrated must, as it shows an initial density of 1093 (or 218 grms. of sugar per litre). The first slight sulphuring is carried out (7.5 grms. of sulphurous acid per hectolitre) and fermentation starts pretty rapidly, being activated by the raising of the must ("remontage"). As early as the third day, dangerous temperatures are reached, and on the fourth the temperature is 37° C. The cooling is then done by a refrigerator, which brings it down to 34° C. and then, after another rise, the must is racked off at 33.5° C. 7 days were required to effect attenuation which was quite inadequate because racking is effected at 1013 (instead of 0.995-0.997 which a normal fermentation of 4 days should produce). 2) The second example, on the contrary, presents the case of a highly accelerated fermentation. After sulphuring with 15 grms. of sulphurous acid per hectolitre, the temperature reaches 35° C. in 12 hours. The first refrigeration entails a gain of two degrees only, then the temperature goes up again to 35° C. and a second refrigeration is effected. Racking is carried out after barely 4 days of fermentation, with an almost normal reduction.

*Possible Solutions.* — It results from these facts that the means customarily used to prevent abnormal rises of temperature in the fermenting vats are powerless in hot years to ensure satisfactory cooling. Consequently the possible solutions are considered, and are brought under two general methods : *A*) wine making is conducted during the hot season, the effect of cooling being increased by resort to artificial cold; *B*) or the principal fermentation should be left over for a temperate period (autumn or winter),

muting the must by a suitable process, which forms the very essence of wine making.

*A.* — In order to increase the effect of refrigeration, either ice must be used for storing cold, or the necessary cold must be produced on the spot by means of a freezing machine. In either case, refrigeration may be effected in the vats direct, or outside, the usual refrigerating agents being retained.

(*a*) For refrigeration in the vats, the addition of ice to the must, which is a watering prohibited by law, is not to be thought of. On the other hand ice floats might be employed, as in breweries. The cooling effect, however, is rather limited owing to the small bulk of the floats, and it is fairly difficult to put the latter in owing to the cap formed by the grape skins. To overcome this difficulty the method proposed by commandant SIGAUT is suggested, which consists in adding to the must to be cooled blocks of must frozen in ice-making machines. There remain the stationary or detachable devices for control of temperature. The fixed ones, which form an expensive and troublesome method cannot be recommended ; the detachable ones, similar to the " flags " utilised in breweries, might render very great service on condition that they are designed in such a way that they can be easily immersed in the small depth of liquid lying above the crust.

(*b*) The system of cooling outside the vats presents the advantage that the already existing refrigerators can be used, it being sufficient to increase their effect by feeding them with frozen water or even with non-freezing brine. The carriage of the ice however in Tunis presents some difficulty, so that it seems desirable to resort to the installation of a small freezing machine in each cellar.

(*c*) There remains the idea, again modelled on breweries, of cooling the whole room in which fermentation takes place, in the hope of securing, by low fermentation, an apparently more rational utilisation of the yeast and smaller losses by evaporation (alcohol and bouquet). The writer, after recording the failure of the attempts made in this direction, considers this process as unrealisable both from the practical and economical point of view.

*B.* — Finally the industrialisation of the wine industry, to be carried on in big factories working throughout the year, appears to be the most satisfactory solution as regards the future of the problem of the wine manufacture in hot countries. It is suggested that the preservation of the must without antiseptics (or after slight sulphuring) might be ensured by keeping in cold storage depots where it would wait for the favourable period for fermentation, after which it would be brought back to the cellar.

*Immediate Solutions.* — Until such time as the industrial methods of breweries are adopted (the really rational solution of the problem), the Author suggests immediate solutions of the problem by which, without heavy cost, the recurrence of difficult seasons such as that of 1913 might be avoided.

The idea of effecting a low fermentation in wine manufacture must be dismissed completely. North African yeasts are excellent yeasts, and it is not expedient to make them work at temperatures below 28-30°C. On the other hand, an increase of temperature in the vats must be prevented

in order not to exceed the fatal figure of 33°C, which may be done by the use of ice or by installing a freezing machine, either system being employed for suitably cooling the water circulation intended for feeding the ordinary refrigerators. The expense of purchase and installation of a small cooling machine is relatively small, and the plant might be utilised for various purposes, the most interesting of which would be the concentration of musts with a view to obtaining " mistelles ". The clarification of young wines by cold, and that of liqueur wines, and the preservation of musts in order to produce " non-alcoholic wines " are also points likely to attract attention.

1016 - **Methods of Detecting the Admixture of Cider to Wine.** — DELLE E., in *Le Moniteur Vinicole*, 61st Year, No. 28, Paris, July 11, 1916.

A fraud is perpetrated whenever a mixture of wine and cider is sold under the name of wine, and it is essential, when the case arises, to detect this fraud by carrying out the analytic and organoleptic investigations by which it may be determined.

According to the writer, one of the safest reactions is the special smell given off by the extract when calcined to ash ; it is easy to recognise the odour peculiar to cooked apples or pears. In order, however, to distinguish this odour quite clearly, the liquid must be gently heated over a burner or a spirit lamp, and the vessel removed from time to time from the source of heat, because if it were maintained in the hot part of the flame irritating smoke would be produced, which would affect the sense of smell and disguise the particular odour sought for. The proportion of alcohol in the extract and the percentage of malic acid should be used to confirm the impression gained in this way.

Furthermore, when cider is distilled, the alcohol has a peculiar smell due partly, but not wholly, to the acetic ether. Its smell is easily detected even in a mixture, by the practised sense.

In conclusion the different chemical methods utilised for determining the percentage of malic acid are enumerated.

1017 - **Preparation of Germ-free Maize Flour ; Investigations in Hungary.** - WEISER ETIENNE, in *Vegyészeti Lapok* (Journal of Chemistry), Year XI, No. 11, pp. 99-10 Budapest, June 10, 1916.

It is well known that flour, semolina and maize bran prepared on the method of grinding generally adopted in Hungary, comparatively soon deteriorate. Their deterioration, which is indicated by a more or less rancid odour, is occasioned by the decomposition of their fatty matter. The bulk of the latter being furnished by the germs, the products could keep for a greater length of time if the germs were removed at the time of their preparation.

HABERLAND and LEG found in 6 samples of maize, from 10.62 to 12.23 % of germs, that is on the average 11.68 lbs of germs per 100 lbs of maize. These results agree with the figures of BALLAND, according to which 100 lbs of maize would yield 12.4 lbs of offals, 74.1 lbs of floury grain and 13.5 lbs of germs. According to BALLAND, the chemical composition of these 3 components is as shown in Table I.

TABLE I. — *Chemical Composition of the 3 components of the Maize Grain.*

| | Husk | Flour | Germs |
|---|---|---|---|
| Water | 9.80 % | 12.10 % | 7.20 % |
| Crude protein | 7.40 | 7.50 | 14.22 |
| Crude fat | 2.10 | 0.95 | 36.98 |
| Crude fibre | 10.15 | 0.35 | 1.85 |
| Ash | 1.30 | 0.60 | 7.30 |
| Nitrogen-free extract | 69.25 | 78.50 | 32.45 |

According to these figures, the maize germ contains as much fat as the seeds richest in fat cultivated in Hungary.

The grinding of the maize grain with germs removed has long been practised in America, and also in Hungary, where, at the "Hungaria" mill (Budapest) the germ separated from the flour and the semolina is added to the bran. Thanks to this process the flour and semolina are capable of being kept for a long time ; on the other hand, the bran mixed in this way with the germ keeps for a very short time only. In addition, this operation precludes any utilisation of the oil contained in the germ.

Mr. JEAN MELEGA, a miller at Orosháza (comitat of Békés), has advised a method of germ removal from grain and extraction of the oil of the removed germs which has attracted the attention of Hungarian millers. This operation being very simple, each mill will be able to prepare flour, semolina and bran germ-freed, and to produce maize oil. The method is as follows :

The maize grains, freed beforehand from impurities, are several times passed through a number of fluted rollers, the flutings in the lower ones being closer than in the upper. The ground grains fall on a bolting machine, which allows the flour and semolina to pass through but retains the germ. The germ is ground and then bolted ; this process is repeated until the bran is entirely removed from the germ. The oil is then expressed from the latter and the oil cake is left behind as a food for livestock.

The writer has analysed all the products of maize grinding taken from the mill of Orosháza, and has obtained the results set out in Tabie II.

TABLE II. — *Chemical Composition of the Products of Maize-grinding.*

| | Water | Crude protein | Pure protein | Crude fat | Crude Cellulose | N. free extract | Ash |
|---|---|---|---|---|---|---|---|
| Whole grains | 16.9 % | 9.0 % | 8.7 % | 4.0 % | 1.7 % | 67.3 % | 1.1 % |
| Flour from grain with their germs | 16.9 | 8.8 | 8.6 | 3.9 | 1.2 | 67.9 | 1.3 |
| Flour from grain with germs removed | 18.2 | 7.2 | 7.0 | 1.6 | 0.7 | 71.7 | 0.6 |
| Semolina with germs removed | 13.9 | 9.0 | 8.1 | 1.4 | 1.0 | 73.7 | 1.0 |
| Bran with germs removed | 12.6 | 9.6 | 9.0 | 6.5 | 10.6 | 58.6 | 2.1 |
| Germ cake | 8.7 | 16.8 | 15.2 | 10.6 | 4.7 | 53.5 | 5.7 |
| Germ before oil is expressed | 16.2 | 14.3 | 13.0 | 17.6 | 3.3 | 43.7 | 4.9 |

The MELEGA process therefore furnished fairly good results : there is a substantial difference in the percentage of fat between the flour of whole grains and that of grains with their germs removed, which would seem to show that the latter flour can be kept longer than that of maize prepared on the method generally adopted hitherto in Hungary. The percentage of fat in the bran is not very much diminished as compared with the corresponding percentage in the bran produced on the old method, which proves that the sample examined still contained a fair amount of germ. According to the analysis of the writer, the content of fat in several other samples of maize bran fluctuated between 7 and 14 %. The content of fat in the germ cake is relatively rather high, which must be attributed on the one hand to the fact that the sample taken had not been sufficiently pressed, and on the other that it still contained a fair amount of bran (the latter retaining a good deal of oil). Therefore the more successfully the husk parts are removed from the germs the more oil will be extracted.

The writer also made a series of investigations into the oil yield, and found that 100 lbs of maize contained 4 lbs of oil. The quantity of the different products of grinding and their percentage of oil was as shown in Table III.

TABLE III. — *Oil Yield of the Maize Grain and its various Grinding Products.*

| | | | | | |
|---|---|---|---|---|---|
| 70 lbs of | flour and semolina | with | 1.6 % | of oil yielded | 1.12 lbs of oil |
| 13 „ | „ germ flour | „ | 17.6 % | „ „ | 2.20 „ „ |
| 8 „ | „ bran | „ | 6.5 % | „ „ | 0.52 „ „ |
| 5 „ | „ flour | „ | 1.4 % | „ „ | 0.07 „ „ |
| 4 „ | „ loss | | | | |
| 100 lbs of | maize yielded . . . . . | | | | 4.00 lbs of oil |

The oil expressed from the germs is transparent and reddish-brown in colour. For its chemical composition the writer found practically the same figures as other workers. When refined, maize oil is edible ; it may also be used for manufacturing margarine and similar fats, coloured soaps, etc.

Several enquiries have been addressed to the Hungarian Station of Biology and Animal Feeding in Budapest as to whether the extraction of the fat from the maize grains will not unfavourably affect the fattening of pigs. No doubt the nutritive value of maize rich in fat is greater than that of maize poor in that substance, because among nutritive substances fat contains the highest value of chemical energy. The writer ascertained that the extraction of the fat reduced the gross value of the chemical energy of maize by 6.25 %. On the other hand, as compared with this relatively small loss, the extraction of the fat from maize entails the following advantages :

The semolina of maize poor in fat keeps better than that from which the germs have not been removed.

With the extraction of the fat there is a slow increase in the quantity of protein, which is of advantage from the point of view of feeding young pigs.

It is well known that maize oil softens the fat of the pig and thus impairs its quality. On the other hand the fat produced by feeding with maize poor in fatty substance is firmer, and thus possesses more value than just mentioned.

1018 – **A Cheap Process for Extracting the Oil from Oil fruits and Seeds and their Residues (black Olives and Oilcakes) by means of non-inflammable Solvents.** — See No. 1006 of this Bulletin.

1019 – **The Conversion of Fruits and Vegetables into Dried Products: Experiments at the Royal School of Horticulture and Pomology of Florence, Italy.** — VALVASSORI V., in *Atti della Reale Accademia economico-agraria dei Georgofili di Firenze*, 5th Series, Vol. XIII, Part 2, pp. 56-64, 1 fig. Florence, April 1916.

For the preparation of dried *pears* and *apples* the best results have been obtained on the following method. The fruits, having been peeled and cut in halves, are subjected to the action of sulphurous anhydride in a chest fitted with gratings, are then scalded in a steam stove and dried in a RYDER drier at a temperature of 80° to 90°C. The length of time found best in the treatment with sulphurous anhydride and with steam, and in drying, were the following respectively :

| | Sulphurous anhydride | Steam | Drying |
|---|---|---|---|
| | — | — | — |
| For the "Coscia" pear . . . . . | 15 minutes | 10 minutes | 8 hours |
| " " "Gentil bianco" . . . . . | 10 " | 5 " | 8 " |
| " " "William" . . . . . | 15 " | 5 " | 8 " |

The " Tondona President ", a non-clingstone peach, peeled, cut into halves, with its stone taken out, sulphured for 15 minutes and kept in a drier at the above temperature for 7 to 8 hours, yielded a fine product. A similar method was adopted with apricots.

In the experiments made with plums, the varieties " Friulana ", " Claudia mostruosa " and " Porcina " were used. The first appeared very well adapted for drying, the second less so, and the last not at all. The " Friulane " plums were subjected partly to the treatment with steam for one and a half minutes, partly to scalding in a boiling solution of 5 % strength potassium carbonate, and afterwards plunged into running water. Both the first and the second were then placed in the drier for 3 days, at first in a closed drier at 50°C., and then at 60-70°C., finally in an open drier at 80-90°C. Both groups came out successfully. The fruits did not crack. Those which had been treated with steam dried more quickly than the others.

" Turca " and " Pistoiese " cherries treated with steam for 5 minutes, then kept in a drier at 80-85°C, dried in about 12 hours and yielded a fine product. Those which had not been treated with steam afterwards required a longer time for drying.

The figs of the " Dottato " variety, peeled or cut open in halves, or whole, treated with sulphurous anhydride for 30 minutes and kept in a drier at 40-50°C. for 2 or 3 days, gave a good result in all cases.

*Length of time during which Vegetables must be scalded or treated with steam; temperature; length of drying and yield of the vegetables mixed to form a " Julienne ".*

| Kitchen Garden Products | Time during which products must be scalded (Sc) or steamed (St) | Drying temperature | Time required for drying | Yield per 100 lbs. of the fresh vegetables | Special solutions for scalding |
|---|---|---|---|---|---|
| Potatoes | Sc 3 to 5 minutes | 50–60° C | 10 hours | 30 lbs. | Steep in water with 0.5 % solution of bisulphite of soda; also for potatoes only, scald in salt water of 2.5 % strength |
| Carrots | Sc 2 1/2 | 60–65 | 10 | 11 | |
| Kohl-rabi | Sc 3 to 4 | 50–60 | 8 | 10 | |
| Headed cabbage, | St 2 to 3 | 50–60 | 7 | 7 | |
| Green cabbage | St 2 to 3 | 50–60 | 7 | 7 | |
| Cauliflower or sprouts | Sc 5 | 60 | 9 | 4–5 | Scald in 3 % salt water. |
| Spinach | St 1/2 | 30–40 | 6 | 6 | |
| Celery leaves | — | 40–50 | 6 | 20 | |
| Kohl-rabi leaves | Sc 2 to 3 | 40–50 | 6 | 8 | |
| Peas | Sc 4 | 40–50 | 7 | 6–7 | Scald in water with 2 ‰ bicarbonate of soda. |
| French beans | Sc 1 | 50–60 | 8 | 8 | |
| Onions | — | 40–50 | 10 | 15 | |
| Leeks | — | 40–50 | 8 | 11 | |
| Turnip roots | Sc 2 to 3 | 50–60 | 8 | 10 | Scald in 3 % salt water. |
| Celery | — | 40–50 | 9 | 6 | |
| Parsley leaves | — | 40–50 | 9 | 18–20 | |
| Turnip leaves | St 1 to 2 | 40–50 | 6 | 8 | |

In the appended Table there are summarised the experimental results obtained by the writer in connection with the drying of mixed vegetables to form a " Julienne ". A mixture in the following proportions is advised, adopted by the School of Pomology of Florence (of which the writer is the director) and a big factory at Gorizia: Potatoes, 30 % ; carrots, 25 % ; kohl-rabi (roots), 3 % ; celery (sticks), 4 % ; headed cabbage, 6 % ; green cabbage, 10 % ; cauliflower, 5 % ; spinach, 1 % ; celery leaves, 1 % ; kohl-rabi leaves, 1 % ; parsley leaves, 1 % ; turnip leaves, 1 % ; French beans, 5 % ; onions, 2 % ; leeks, 2 % ; turnips (roots), 3 %.

1020 - **Utilisation of Cherry By-products.** — RABAK FRANK, in *U. S. Department of Agriculture, Bulletin* No. 350, 24 pp. Washington, D. C., March 10, 1916.

In the North Atlantic, North Central and Western States of the North American Union, the cherry preserving industry is extensively developed, and enormous quantities of unutilisable fruit, stones and juice are turned out, which are at present wasted, though it would be possible to convert them into products of great commercial value.

According to the 13th census of the United States, in 1909, the production of cherries was 271 597 bushels in the State of New York, 338 945 bushels in that of Michigan, 81 340 in Wisconsin, and 501 013 in California. The present production is no doubt very much greater. About 80 % of the crop is converted into preserves.

Of the two by-products, stones and juice, of the cherry preserving and jam making industry, the stones have the greater commercial value ; they represent about 15 % by weight of the cherries. The writer calculates that in 1914, 1 400 tons of them were produced in the Union. The juice which comes out together with the stones when the latter are removed is estimated at about 70 gallons per ton of cherries. Consequently the quantity lost is approximately 112 000 gallons per year.

As is evident from the experiments made by the writer, it is possible by means of solvents to extract from the stones of crushed cherries 8.3 % of a fatty oil (pit oil) ; or they can be broken, the kernels taken out, and from the latter by hydraulic compression about 30 % of fatty oil (kernel oil) extracted. The resulting oil cake steeped in water and afterwards distilled in a current of steam, furnishes about 1 % of a volatile oil ; the residue of this distillation, when reduced to flour, may be used for cattle feeding.

Of the two above mentioned oils, the fatty oil is light golden yellow in colour ; it has a bland and agreeable odour, and a fatty taste recalling that of the nut. It does not differ essentially from the oils of sweet almonds, peaches or apricots ; it should therefore have a commercial value approaching theirs, and be capable of the same uses, namely, pharmaceutical, food, soap manufacture, etc. The volatile oil is for all practical purposes equal to that of bitter almonds, and may be put to the same uses in pharmacy, perfumery, manufacture of sugar-almonds, etc.

Table I sets out the physical and chemical characters of the fatty pit oil (extracted with ether) and kernel oil of cherries ; Table II, the characteristics of the volatile oil ; and Table III the composition of the oil cake.

TABLE I. — *Physical and chemical characteristics of fixed cherry oil.*

| | Stone oil | | Kernel oil |
|---|---|---|---|
| | crude | refined | |
| Specific gravity at 25°C. | 0.9019 | 0.9137 | 0.9092 |
| Index of refraction at 25°C. | 1.4635 | 1.4641 | 1.4635 |
| Freezing point | 11° to 12° C | 12° to 12°.5 C | 13° to 13°.5 C |
| Neutralisation index | 192.4 | 179.7 | 180.8 |
| Iodine index | 99.9 | 93.7 | 92.8 |
| REICHERT-MEISSL figure | 6.32 % | 3.665 % | 4.72 % |
| Soluble acids (reckoned as butyric acid) | 1.22 % | 0.473 % | 0.469 % |
| Insoluble acids | 99 % | 92.5 % | 92.8 % |
| Acetyl value | 20.3 | 3.45 | 12.67 |
| Non-saponifiable | 2.45 % | 1.12 % | 0.44 % |

TABLE II. — *Physical and chemical characteristics of volatile cherry oil.*

| | Oil extracted from the pit oil cake | Oil extracted from kernel oil cake |
|---|---|---|
| Colour | light yellow | golden yellow |
| Smell | pleasant, strong, bitter almond | pleasant, characteristic |
| Taste | sweet, very tart | sweet, very tart |
| Specific gravity at 4°C | 1.050 | 1.012 |
| Hydrocyanic acid | 4.21 % | 7.94 % |
| Benzoic acid | 81.53 % | 67.95 % |

TABLE III. — *Composition of cherry kernel cake (after extracting the fatty oil and the volatile oil, and dessiccation).*

| | |
|---|---|
| Moisture | 1.06 % |
| Ash | 3.94 |
| Protein | 30.87 |
| Nitrogenous substances | 42.13 |
| Cellulose | 8.90 |
| Ethereal extract | 13.10 |

The writer calculates that the United States might produce each year *a*) 268 000 lbs of fatty cherry oil, of a value approximate to that of peach oil, which has ranged from 22 cents per lb in 1913 to 45 cents in 1915 *b*) 6 000 lbs of volatile oil of a value close to that of the oil of bitter almonds which in January 1916 was quoted at 9.25 to 11 dollars per pound ; *c*) about 300 tons of distilled oil cake flour.

The juice obtained on extracting the stones is a light red liquid, with a taste and smell characteristic of the cherry. 1) By neutralising the acidity of the juice with milk of lime, and afterwards filtering and evaporating, a syrup is obtained of an agreeable, sweet, slightly tart flavour. The yield of syrup is about 20 % of the juice. 2) By fermenting the juice and afterwards distilling it, 4.6 % of alcohol of 95 % strength by volume is obtained. 3) By concentrating the juice with an addition of pectine or other gelatinous substances and sugar (1 lb of sugar per 1 200 cc. of juice), an excellent jelly is made.

If the whole of the juice turned out annually in the United States were converted into one of these three products, there would be 5 000 gallons of alcohol, or 21 000 galls. of syrup, or 85 680 galls. of jelly. In view of the large demand for these last two products, their manufacture would undoubtedly be the most profitable.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

1021 – **The Dairy Industry in Argentina and Plans for its Future Development.** — Berges Pedro, in *Anales de la Sociedad Rural Argentina*, Year LI, Vol. 4, pp. 81-131, 21 figs. Buenos Aires, March-April 1916.

This work received a prize in a competition for an essay on scientific agriculture, livestock and agricultural industries, organised by the " Sociedad rural argentina " in connection with the International Exhibition of Agriculture in 1910. It deals with the following subjects : the present state of the dairy industry, sanitary inspection; control of the quality of milk intended for human consumption and for butter making ; economic returns of the dairy industry, comparison of the conditions of this industry in Argentina with its conditions in those countries where it has attained its greatest development ; methods to be adopted in order to effect reliable and rapid progress.

I. — Origin and present condition of the dairy industry in Argentina — (a) *Production and consumption of milk and dairy produce.* Until 1894, the milk products were so limited in quantity that there was practically no necessity to export. In that year exportation to England and France began, and afterwards to Brazil, Paraguay, Uruguay, Bolivia, Belgium and Italy. From 1894 to 1899, there were exported in all 3 044 tons of butter. The figures for the following year are set out in table I. This table shows that during the five-year period 1902-1906, the dairy products industry in Argentina underwent some development, which was followed by a retrogression in the following five years, although the country possesses 15 million cows, of which little more than 2 million were classed as dairy cows in the cattle census of 1908. Thus, from 1905 onwards, the exportation of condensed, sterilised and desiccated milk is seen to disappear from the statistics.

During the period 1903-1908, the consumption of butter in Argentina remained stationary ; that of cheese increased by 3 2000 000 kg. though the corresponding increase in the national production was only 687 000 kg. During the period 1903-1912, the consumption averaged 700 gr. of butter and 550 gr. of cheese per inhabitant per year. Condensed milk and malted milk are furnished almost exclusively by importation, which is con-

tinuously growing. Comsequently, while the national consumption of milk products undergoes continuous increase, the manufacture of cheese and condensed milk is falling off and becomes more and more incapable of meeting the need.

b) *Extension of the industry in the country.* — Dairies are concentrated in the environs of the capital of the Republic and in the provinces of Buenos Aires, Entre Rios, Santa Fé and Cordoba. In 1907, which is the most recent year for which statistics are available, there were in Argentina 409 dairies, 29 butter factories, 85 cheese factories and 56 mixed establishments, of which 330,23,69 and 37 respectively were in the province of Buenos Aires, including the capital. The total quantity of milk treated in these establishments was 206 822 196 kg. of which 173 684 354 kg. in the city and province of Buenos Aires. The number of establishments nearly doubled from 1903 to 1908. It is on the increase in all the provinces, particularly those of Buenos Aires and Santa Fé.

TABLE I. — *Export and import of dairy products in Argentina during the period* 1900-1915.

| Year | Exports | | | | Imports | | | |
|---|---|---|---|---|---|---|---|---|
| | Butter | Cheese | Casein | Condensd sterilised, and powdered milk | Butter | Cheese | Condensed milk | Malted milk |
| | kg. | kg. | kg. | kg. | kg. | kg. | kg. | kg. |
| 1900 | 1 056 000 | 856 | — | — | — | 1 373 882 | — | — |
| 1901 | 1 051 000 | 1 349 | — | — | — | 1 411 222 | 28 213 | — |
| 1902 | 4 125 000 | 6 520 | 94 074 | — | 120 | 1 639 682 | 27 312 | — |
| 1903 | 5 330 000 | 3 869 | 319 614 | — | — | 1 129 364 | 31 555 | — |
| 1904 | 5 294 000 | 7 459 | 1 694 883 | 31 530 | — | 1 845 769 | 43 894 | — |
| 1905 | 5 393 000 | 2 452 | 3 020 000 | 8 275 | 180 | 1 920 790 | 58 793 | — |
| 1906 | 4 405 000 | 285 | 3 081 000 | — | — | 3 313 343 | 133 185 | 92 771 |
| 1907 | 3 035 000 | 950 | 2 035 000 | — | 514 | 3 295 688 | 175 228 | 113 076 |
| 1908 | 3 550 000 | 1 000 | 2 058 000 | — | 345 | 3 667 612 | 155 655 | 135 331 |
| 1909 | 3 993 000 | 0 | 2 775 000 | — | 35 050 | 4 030 057 | 268 359 | 171 044 |
| 1910 | 2 876 000 | 367 | 2 973 000 | — | — | 4 325 476 | 278 368 | 143 172 |
| 1911 | 1 396 000 | 518 | 2 169 000 | — | — | 4 919 437 | 344 605 | 207 245 |
| 1912 | 3 677 000 | 1 942 | 3 501 000 | — | — | 5 374 584 | 348 028 | 224 673 |
| 1913 | 3 784 000 | 7 342 | 3 446 000 | — | — | 5 045 040 | 437 042 | 177 578 |
| 1914 | 3 482 000 | 3 727 | 2 925 000 | — | — | 3 834 367 | 259 184 | 138 964 |
| 1915 | 4 623 000 | 6 053 | 2 608 000 | — | — | 3 313 959 | 208 008 | 90 144 |

II. — SANITARY INSPECTION OF MILK PRODUCTION AND BUTTER MAKING. — The sanitary inspection of milk, as organised in the great dairy in-

dustry countries, does not exist in Argentina. Some municipalities alone, such as those of Buenos Aires, Rosario, Mendoza and Cordoba, have introduced compulsory tuberculin inoculation in city cow sheds(" tambos ") ; but as only the municipality of Buenos Aires grants an indemnity for the animals lost through this practice, this inoculation causes great injury to cow keepers. The latter often attribute disease to the inoculation, and oppose the use of this preventive treatment. As regards rural cow sheds, tuberculin inoculation was imposed by the order of the 16th December 1889 and the additional decree of the 27th May 1901. These enactments were set aside by the General Direction of Health in consequence of a petition from the Argentine rural Society, as the manner in which they were applied was not in keeping with the precepts of hygiene. The general sanitary police regulations, approved by decree of November 1906, conferred on the live-stock division of the Department of Agriculture the right of inspection in all that related to this branch of production. Articles 41 and 42 provide that all cow sheds where milk is produced and treated may be inspected by the above Division, for the purpose of sampling milk and subjecting it to bacteriological analysis. All the establishments in whose products the bacillus of tuberculosis has been found are compelled to pasteurise the milk sold or handled by them. Nevertheless, so far, this enactment has not been enforced.

On the initiative of Dr. Baldomero Sommer, the municipality of Buenos Aires in February 1910 enforced an order promulgated on the 13th December 1907, declaring " hygienisation " of milk intended for consumption in the city of Buenos Aires to be compulsory. The order gives the widest possible sense to this term " hygienisation ". It was cited by way of example to other towns at the international Refrigeration Congress held at Paris in 1908.

In Buenos Aires, the death rate for children below one year was,in 1889, 19.3 % of the children born viable ; in 1909 it had fallen to 9.9 %, which diminution the writer attributes to the hygienic control of infant food.

An order of the Direction of Health of La Plata inposes very strict supervision over factories of dairy products employing steam plant.

Cream is not subjected to any sanitary measure.

III. — Testing the Quality of Milk and Butter Making. — An inspection of this kind is only adopted by the municipalities of Buenos Aires and Rosario. The most frequent adulterations are watering and skimming. The Author mentions a curious method of effecting skimming when the milk is being delivered ; the milkman places a skimmer beneath the seat of his cart, the blades being driven by means of a belt which takes its movement from the wheels.

The decree of the 4th October 1904 provided inspection for butter manufacture and the " Comisión nacional de Lechería " in July 1905 submitted a scheme for regulations under this decree. It limits inspection to the factories of butter for exportation; the decree has never been enforced.

The absence of supervision of the quality of milk and of butter mak-

ing in Argentina are said to be a considerable hindrance to the progress of this industry.

IV. — Economic results obtained by the Dairy industry in the Argentine Republic. — According to official data, the cream and cheese yield of milk and the butter yield of cream are as follows, being the averages for the years 1903 and 1905-1907 :

| | |
|---|---|
| Cream yield of milk | 7.25 % |
| Butter yield of cream | 51.35 » |
| Cheese yield of milk | 9 » |

The quantity of milk produced per cow is very variable. In urban cow-sheds it is 2.64 galls. per day or even more, and for some cows goes up to 4.4 galls. In rural cow-sheds it averages 1.3 to 1.5 gallons, but here too cows are found yielding 4.4 to 6.6 galls. According to M. Lahitte (1903), the average production of the country is 0.77 galls. per dairy cow, with a butter yield of 3.5 %. On the whole the butter yield is good, but the milk yield is low. This disadvantage, however, is partly set off by the large number of cows available and the little attention required by dairy cows. The machines used are of the most improved types. The butter ranks fifth on the London market, after Danish, French, New Zealand and Dutch products; this is due to the length of time for which it is cold-stored in transit.

No form of co-operation in the dairy industry exists. The writer advises the installation of co-operative dairies in the distributive centres in order to reduce the costs of carriage by railway and taxes on dairies, while at the same time ensuring supervision of the quality of the products.

V. — Considerations on the Dairy Industry and Dairy Products in certain countries. — The writer studied this industry in Denmark, Holland and Siberia, and he arrives at the result that: 1) these countries owe their progress to co-operation, and Siberia also to Government action, which has enabled that country to gain within a space of ten years the second place in the world's output of butter; 2) the cattle stock of these countries is inconsiderable if compared with that of Argentina, which proves that it is not necessary to have a large number of cows in order to produce butter; 3) in Siberia, cows are badly fed and neglected from October to March, and drought is frequent. The writer notes this fact, because in some quarters the want of development of this industry in Argentina is attributed to insufficient feeding ; 4) in order to obtain 1 lb. of butter, there is required in Denmark 26.5 lb, of milk ; in Holland, 30 ; in Siberia 22 ; in Argentina 28.

VI. — Industrial Capacity of Provinces and Territories in Argentina in reference to Output of Milk amd Milk Products. — *Quantity of Livestock and Conditions of Environment.* — In Table II particulars are given as to the number of farm properties with an area of more than 24 acres and the number of dairy cows " vacas de cría " (breeding cows) and other milk yielding animals (ewes, goats and camels) in the provinces and territories of the Republic.

Cheese-making finds favourable conditions in the region of the Andes and the territories of Pampa, Neuquén, Chubut, Río Negro, Santa Cruz and Tierra del Fuego, because cool animal housing quarters are available during the greater part of the year.

TABLE II. — *Distribution of Milk-yielding Animals in Argentina (Livestock Census of 1908).*

| | Farm properties over 24 acres | Dairy cows | Breeding cows | Sheep | Goats | Camels |
|---|---|---|---|---|---|---|
| *Provinces* | | | | | | |
| Buenos Aires | 45 023 | 656 640 | 4 491 588 | 21 109 609 | 11 335 | — |
| Santa Fé | 27 104 | 186 510 | 1 446 657 | 596 411 | 35 596 | — |
| Entre Rios | 13 893 | 203 800 | 1 533 524 | 3 936 902 | 31 748 | — |
| Corrientes | 10 394 | 206 165 | 2 388 052 | 1 805 745 | 29 978 | — |
| Santiago del Estero | 4 359 | 88 107 | 222 566 | 435 839 | 705 127 | — |
| Cordoba | 25 896 | 217 233 | 898 164 | 1 245 764 | 810 831 | — |
| Tucumán | 6 443 | 55 098 | 114 107 | 82 720 | 101 394 | — |
| Salta | 3 453 | 71 019 | 209 813 | 194 590 | 217 054 | 29 700 |
| Jujuy | 4 472 | 8 152 | 46 456 | 535 447 | 133 656 | 42 516 |
| Catamarca | 4 633 | 26 506 | 101 403 | 97 524 | 311 548 | 828 |
| Rioja | 3 146 | 59 873 | 163 140 | 77 281 | 359 811 | — |
| San Juan | 1 658 | 3 156 | 31 975 | 61 800 | 90 796 | — |
| San Luís | 5 485 | 59 876 | 224 399 | 535 447 | 468 216 | — |
| Mendoza | 2 325 | 22 968 | 142 774 | 187 526 | 205 427 | — |
| *Territories* | | | | | | |
| Chubut | — | 27 846 | 157 305 | 1 212 501 | — | — |
| Neuquén | — | 26 195 | 82 225 | 503 221 | 170 919 | — |
| Pampa | — | 24 465 | 205 057 | 3 065 807 | 113 161 | — |
| Río Negro | — | 25 025 | 128 420 | 3 140 466 | 76 698 | — |
| Santa Cruz | — | 1 639 | 10 075 | 1 371 324 | 582 964 | — |

*Feeding of Dairy Animals.* — In 1908 Argentina possessed 6 728 876 hectares of artificial grasslands, of which 4 656 707 ha. were under lucerne (an area exceeding that of Denmark,) and in addition the immense rich natural pasturages. It also exports many concentrates (bran, oil cakes, etc.), Consequently the production of cheese exeeds the quantity required for the country.

MEASURES CALCULATED TO PROMOTE THE PROGRESS OF THE DAIRY INDUSTRY. — The Author in this connection, reproduces the opinions of Messrs. GIBSON, LAHITTE, BERGÉS, FYNN and PEREZ. They are unanimous in think-

ing that co-operation must be developed and an immediate demand made for: 1) the reduction of the carriage rates and the provision of cold storage wagons in sufficient quantity (LAHITTE, BERGÈS and FYNN); 2) the abolition or reduction of taxes (LAHITTE, BERGÉS, FYNN AND PEREZ); 3) the inspection of milk intended for consumption (BERGÉS) and butter (LAHITTE, BERGÉS and PEREZ); 4) the sanitary inspection of cow-sheds (BERGÉS); 5) the foundation of practical schools for the dairy industry (LAHITTE and BERGÉS); 6) shows of animals and products (BERGÉS, FYNN, and PEREZ).

The writer is in favour of cooperation and even of compulsory co-operation, as likewise of the establishment of mixed co-operative societies of producers and farmers. He studies in detail the question of the establishment of co-operative societies in each of the milk-producing provinces, with geographical maps of the latter; he also treats of the scientific, economic and legal bases for the " hygienisation " of milk, and concludes by setting out a draft law which embraces all his desiderata.

*Practical Results.* — The writer presented his essay in 1910 and from that date to 1916 he has secured: 1) the establishment in January 1911 of a dairy industry bureau in the General livestock Direction; 2) the promulgation on the 20th August 1915, of a law declaring the " hygienisation " of milk compulsory in every town with more than 10 000 inhabitants, and proposing the establishment of mixed co-operative societies; 3) the holding of a series of lectures the result of which was the creation of 5 supervising and inspecting societies, 2 of which in particular are in operation; 4) the promulgation of a decree under date of the 17th December 1915, which establishes national inspection of dairy products; 5) the publication by the Dairy Industry and Refrigeration Bureau of an edition of 20,000 copies of a booklet in which the dairy qualities of cattle are discussed; 6) the creation of educational provisions for the improvement of the dairy industry, in the faculty of medicine and veterinary science of Buenos Aires, and in a large number of schools of agriculture.

1022 – **Influence of Mechanical Milking with the " Omega " Milker on the Bacteriological Composition of Milk.** — BURRI R. and HOHL JOH., in *Landwirtschaftliches Jahrbuch der Schweiz*, XXXth year, Part 2, pp. 241-255. Berne, 1916.

The experimental Station of Berne-Liebefeld has carried out a series of experiments in mechanical milking with the " Omega " milker, with a view to determining not only the economic desirability of mechanical milking under the conditions peculiar to Switzerland, but also its influence on the milk production of cows (1) and that exerted on the bacteriological composition of the milk, as compared with hand milking.

The report subimitted by the writers is preceded by a short bibliographical statement on the question, and gives in detail the results of the bacteriological analysis of samples of milk obtained under the following conditions:

1) Mechanical milking on the methods usually employed for cleaning the milking appliances;

(1) See *B.* 1913, N° 1073. (*Ed.*)

2) Hand milking on the methods generally practised ;

3) Mechanical milking, steam being used for cleaning the appliances under special laboratory conditions.

4) Mechanical milking, using hot solutions of caustic soda for cleaning the appliances under normal conditions in the cow-shed and without the use of steam ;

5) Hand milking with special methods of cleaning.

The results of the bacteriological analysis comprising the determination of the number of bacteria per cc., the presence of gas-producing bacteria of the group of *Bacterium coli*, and their behaviour under the fermentation test, led the writers to the following observations :

1) The quality of the milk as regard the species and number of the bacteria it contains, varies within much wider limits in mechanically milked than in the hand milked article, as an incomplete cleaning of the apparatus facilitates the accumulation of a large number of bacteria which, at the following milking, easily get into contact with the milk which is almost free from germs on leaving the teat. This deteriorates the keeping properties of the milk, and the latter must be regarded as of inferior quality both from the point of view of health and that of the dairy industry.

2) On the other hand, by using special methods to ensure the utmost cleanliness of mechanical milking appliances, there is obtained on this method a quality of milk which, with respect to purity and keeping properties and the number of bacteria it contains, answers all requirements ; it is superior to any hand milked product, on condition, of course, that the appliance is applied to a perfectly clean teat.

3) In order to obtain an equally high degree of purity with mechanical milking, it suffices to use a hot solution of 0.2 % strength of soda (47 to 50° C) when cleaning the appliances inside and out which the brush, flushing them out before and after with a jet of clean water.

4) In view of the facility with which mechanical milking may cause deterioration in the quality of milk when the above rules are not constantly and strictly, followed, it is desirable, both in the interests of hygiene and the dairy industry, that wherever the introduction of this method of milking is justified from the economic standpoint, it should only be entrusted to conscientious and trustworthy persons.

1023 – **A New Defect in Milk Caused by *Bacterium Lactis Aerogenes* Escherich.** — Duggeli Max, in *Zeitschrift für Gärungsphysiologie*, Vol. 5, No. 5, pp. 321-340. Leipzig, 1916.

The writer received for examination 2 samples of bottled milk suffering from a hitherto unknown and very pronounced defect, although the samples reached the laboratory only 48 and 60 hours after milking. They came from a model cow-house of 36 cows producing best quality milk, obtained and handled with the utmost cleanliness, afterwards filtered, cooled to 12-14°C and bottled for forwarding to the consumers. When the milk from this shed had been kept for some time, a bitter taste was observable, together with a typical rancid smell, especially noticeable when boiling the

milk ; and this fault became more strongly pronounced as the time of keeping was lengthened.

All atempts to discover the presence of bitter substances failed.

The ration of the cows was made up of good hay and crushed barley, not very fresh it is true, but of normal bacteriological composition. On studying the fresh milk of the 36 cows separately no result is obtained, but by keeping the different specimens of milk it was detected that the defect was due to one cow with a diseased teat, an old animal which had been in milk for a year and a half.

A thorough bacteriological study of the above 2 specimens of milk was made, all kinds of cultures being prepared. The writer succeeded in isolating a bacterium belonging to the group *Bacterium lactis aerogenes* Escherich, but differing from the stock form of *Aerogenes*, and he considers this to be the cause of the defect in question. It not only gives rise to abnormal smell and taste in the milk, but also possesses the property of making glucose bouillon very ropy. Furthermore, even in the presence of *Bacterium Güntheri* L. et N., it prevents the coagulation of the milk. On cultivating the bacterium producing the defect in question on lactose agar, the caracteristic taste and smell disappear, but they can be made to reappear in part by afterwards cultivating the bacterium in a suitable medium (decoction of teat substance).

1024 – **Manufacture and Composition of Bulgarian Cheeses.** — ZLATAROFF, A. S. (Communication of the Laboratory of the University of Sofia), in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*, Vol. 31, No. 12, pp. 387-394. Münster i. W., June 15, 1916.

In Bulgaria, in addition to the cheeses peculiar to the country, foreign cheeses (Gruyère, Roquefort, Chester, etc.) are manufactured, but their production does not exceed 5 % of the total output. The bulk of the latter is made up of the specific cheeses of the country, " Bulgarian cheese " proper and " Kaschkawal ", which are described below.

1) *Bulgarian Cheese.* — Belongs to the group of ordinary white cheeses and the sub-group of salted soft cheeses ; it is prepared from ewe's milk, but in a few rare cases also from goat's and buffalo's milk. The milk is worked immediately after milking at a temperature of 30 to 35°C., often in very large quantities coming from entire mountain flocks. The milk after milking is passed hot through a cloth filter into large cans, and either natural rennet, or, according to recent practice, artificial trade rennet, is added. In these cans, which have wooden lids and are surrounded by a woollen cover to retain the heat, the renneted milk is allowed to remain 1 ½ to 3 hours according to the outside temperature. After that time the whole of the milk has curdled. The curd is thoroughly stirred up for some minutes, and then poured into a cloth filter to remove the whey. The cloth is hung up with its contents and the whey drained off, after which the curd is put into wooden moulds where it remains for 2 to 3 hours. After this operation, the curd is cut up into regular cubes of 15 to 20 cm. each side which are well salted and arranged in layers in wooden vessels. On each layer vine leaves are placed, and the whole is afterwards pressed down with a stone. The vessel is kept in a cool spot, the whey runs off from the pieces of cheese, and

after a time the whole of the cheese lies in a bath of whey, in which it ripens ; the duration of the process of ripening varies according to the cheese maker. On the market, cheeses of more or less advanced stage of ripening are found.

The finished cheese put on the market is completely white and is soft and friable. Its taste, slightly tart and piquant, varies according to the degree of ripening and the manner of keeping the finished product (whether kept on the mountain, in the valley or in town). The older the cheese the more it tends to take on a consistency resembling that of hard butter, so that it can be easily spread on bread. After keeping 6 to 8 months the cheese partly loses its taste ; if it is made with skim milk its taste is not so pleasant. This latter method is regarded as fraudulent, although there is no law prohibiting this cheese being sold as though made from full cream milk. A good cheese should never contain holes.

2) " *Kaschkawal* ". — This belongs to the group of cooked cheeses and the sub-group of solid and sour descriptions. The raw material (milk) is put through the same treatment as in the manufacture of ordinary Bulgarian cheese, but always consists of ewe's milk and never buffalo milk. After passing through the filter the mass of curd is wrapped in the cloth and the latter is twisted so as to wring out the whey ; to promote drainage the casein is also pressed by hand. These operations distinguish " Kaschkawal " manufacture from that of ordinary Bulgarian cheese. When the whey is drained off, the casein is put into wooden moulds, then thoroughly triturated between the fingers ; the cloth is twisted a second time and the curd once more pressed by hand to force out the rest of the whey.

For this secondary fermentation the curd, freed from the whey, must remain in the cloth for some days. If the weather is hot, the secondary fermentation takes from 3 to 5 hours ; if cold, 2 days. The process is judged according to the colour of the mass, which should be a light yellow, and the content of " eyes ", which must have a diameter amounting to 1 cm. If fermentation takes place slowly, owing to low outside temperature, whey is poured into the curd.

On completion of the secondary fermentation, the casein is cut up into long pieces of an average weight of 50 to 60 gr. which are placed in a water bath at 50-60°C.; they are left in this for 8 to 10 minutes and thoroughly kneaded by hand. The paste thus becomes spongy and is shaped into balls weighing 1, 2, 5 or 7 kg., which are placed in metal moulds; here they remain 3 to 5 days, cooling and solidifying.

When this operation is completed, the balls are taken out and salted, and kept in layers. The cheese should be salted every day for 10 to 25 days, and is then kept in a well ventilated spot. The cheese is stored for about 1 month until fermentation is completed.

" Kaschkawal " is found on the market under two names : " fresh " Kaschkawal which is offered for sale immediately after salting, and " old " Kaschkawal or the completely ripened article. The colour of Kaschkawal is light yellow ; the slightly tart flavour resembles that of original Gruyère ;

TABLE I. — *Composition of ordinary Cheese and of " Kaschkawal ".*

| Constituents | Ordinary cheese 20 samples | « Kaschkawal » fresh, 10 samples | « Kaschkawal » old, 17 samples |
|---|---|---|---|
| Water | 42.37 to 64.06 % | 38.90 to 44.90 % | 24.91 to 33.92 % |
| Proteins | 14.08 » 27.51 | 21.84 » 27.40 | 19.06 » 27.46 |
| Decomposition Products of proteins | 2.20 » 5.88 | 2.12 » 3.62 | 8.08 » 11.14 |
| Fatty substance | 9.75 » 25.10 | 22.88 » 28.12 | 27.05 » 34.03 |
| Total ash | 3.45 » 4.94 | 2.90 » 4.38 | 4.99 » 7.75 |
| Sodium chloride | 1.10 » 3.12 | 0.20 » 1.68 | 2.02 » 4.20 |
| Lactose, lactic acid, etc., by difference | 0.27 » 6.05 | — | — |

TABLE II. — *Modifications of the proteins in " Kaschkawal " in course of ripening.*

| Age of the cheese | Unaltered proteins | Water soluble protein |
|---|---|---|
| Fresh, on leaving the water bath | 31.08 % | 0 % |
| 3 days after leaving the water bath | 30.08 | 1.00 |
| 6 » » » » » » | 29.12 | 1.96 |
| 10 » » » » » » | 28.22 | 2.86 |
| 15 » » » » » » | 26.78 | 4.30 |
| 20 » » » » » » | 23.97 | 7.11 |
| 25 » » » » » » | 22.31 | 8.69 |
| 30 » » » » » » | 20.93 | 10.15 |
| 40 » » » » » » | 20.20 | 10.80 |
| 60 » » » » » » | 19.80 | 11.28 |

its consistency is very firm ; there are few holes or " eyes " in the body of the cheese (their diameter being 0.5 to 1 cm.).

The chemical composition of " Kaschkawal " was studied by the writer in the Laboratory of applied chemistry of the University of Sofia. Table I sums up the results of 27 analyses and shows that the composition of " Kaschkawal " generally resembles that of Dutch cheese.

The chemical composition of " Kaschkawal " was more thoroughly studied by determining the unconverted proteins and those which had become soluble in water, in reference to the different periods of ripening. These analyses (reproduced in Table II) were made in the uplands, where " Kasch

kawal " is generally manufactured, according to samples from one and the same piece of cheese. From them it may be concluded that the process of ripening first progresses with fair rapidity, then slows down, and ends after 40 days.

At the close of his work the writer gives some information as to the national importance of cheese-making in Bulgaria. Before the Balkan wars the total production was 22 to 25 million kilograms per year. The greater part of the cheese is consumed within the country. From 1907 to 1911, the exportation of ordinary Bulgarian cheese attained the following figures :

| Year | Quantity in kg. | Value in francs |
|---|---|---|
| 1911 | 1 087 775 kg. | 894 141 fr. |
| 1910 | 543 105 | 415 358 |
| 1909 | 620 312 | 493 419 |
| 1908 | 456 160 | 335 676 |
| 1907 | 704 539 | 548 627 |

It is chiefly exported to Turkey (Constantinople), but also in small quantities to Egypt and Greece.

The production of " Kaschkawal " is less extensive. In the five-year period preceding the Balkan war it amounted to about 5-6 million kilograms. " Kaschkawal " is made in specially equipped cheese factories.

From 1907 to 1911, exportation showed the following figures.

| Year | Quantity | Value |
|---|---|---|
| 1911 | 2 336 450 kg. | 3 119 293 fr. |
| 1910 | 2 673 450 | 3 278 501 |
| 1909 | 1 746 509 | 2 193 259 |
| 1908 | 2 083 114 | 2 446 317 |
| 1907 | 1 186 222 | 2 060 641 |

" Kaschkawal " is chiefly exported to Turkey, but small quantities also go to Egypt and Greece.

1025 - **Researches into the Content of Bacteria and Catalase in Hen's Eggs.** — RULLMANN, in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 45, No. 6-12, pp. 219-230. Jena, April 22, 1916.

These researches have demonstrated that in eggs free from bacteria catalase is an original substance. It occurs both in fresh and in preserved eggs. Its quantity, independently of the age of the eggs, varies from 0.5 cc. to 7.6 cc. per 10 cc. of substance.

In broken eggs, the quantity of catalase showed a reduction as early as 24 hours after breaking. In one case, however, it increased from 2.5 cc. to 5 cc.

The catalase contained in rotten eggs could not be determined by means of EIJKMAN's fermentation tube without having been diluted. The diluted

catalase was diminished during the first 6 days when kept in an ice safe, after which the amount remained stationary.

All the eggs, with the exception of those in process of putrefaction, were free from bacteria.

AGRICULTURAL PRODUCTS : PRESERVING, PACKING, TRANSPORT, TRADE

1026 – **Farmer's Elevators in Minnesota, United States of America.** — WELD L. D. H., in *The University of Minnesota, Agricultural Experiment Station*, Bulletin 152, pp. 1-24. University Farm, St. Paul, August 1915.

The movement which led to the establishment of farmer's elevators seems to have had its inception about 1890 in the State of Minnesota. Before that time, the grain trade (bulking, storage and forwarding) was in the hands of companies owning elevators along the railway lines (line elevator companies), having their principal office in towns such as Minneapolis and Chicago. At the outset, although these companies rendered great service to the grain trade, they showed themselves at times to be hard bargain drivers in their contracts with the growers from whom they bought the grain direct ; they also forced prices up and down according to their interests. Although these practices were perhaps not so current as is generally supposed, farmers, having got wind of them, became distrustful of the state of things. They therefore combined to erect co-operative elevators, the number of which rapidly increased, to the detriment of the elevators belonging to non-agricultural Societies or Companies. In 1906 there were 1 199 Company elevators in Minnesota as against 151 farmer's elevators. In 1912, according to the Railroad and Warehouse Commission, these figures changed to 777 and 300 respectively. This Commission regarded as elevators belonging to farmers those which styled themselves farmer's elevators, though in reality many pass under that name without really belonging to farmers.

On the 1st January 1914, an enquiry was opened by virtue of a law passed in 1913 by the legislative body of Minnesota, authorising the University of Minnesota to collect annual reports on the cooperative movement. According to this enquiry, at the 1st January 1914 there were 270, and at the 1st January 1915, 278 elevators in respect of which farmers held more than 50 % of the shares. The total business turnover done by the 270 agricultural societies existing in 1914 and owning elevators may be estimated at $30 000 000 ; these societies sell about 30 % of the whole of the grain sold by the farmers of Minnesota.

The enquiry laid down the bases on which an elevator may be considered as " co-operative ". The three essential points in co-operation are: the principle of the individual vote in resolutions (instead of the system of voting by which each member has a number of votes proportional to the shares he holds), limitation of the number of shares which may be held by one member, and distribution of profits rateably to the business transacted by the Society with each member. About one third of the Societies limit the interest paid on shares and distribute the profit balance in proportion to the business done by each partner. The interest paid on the shares ranges from 5 to 10 %. In other words, the rateable distribution of profit has not been that most commonly adopted, and where it has been adopted, the society generally pays a higher rate on shares than the current interest.

Consequently farmer's elevators are not, properly speaking, co-operative undertakings in the true sense of the word.

The dividends paid by the Societies are of course very variable. In 1913-1914, the position of these establishments was very prosperous. Of the 161 Societies about which the writer possesses information, 64 paid no dividends (20 of them losing money), 66 paid a dividend below 10 %, 18 a dividend between 10 and 20 %, 8 between 20 and 30 %, and 5 a dividend exceeding 30 %.

The managers of farmer's elevators were, at the beginning, often much under-paid, which resulted in certain mishaps. At present the salaries of managers range from $60 to $165 per month, with an average of $90. The reports received for 1912-13 show that in those elevators which were losing money the manager's salaries were about $10 per month less than those of the managers of profit-earning elevators. The managers are, in the majority of cases (78.2 %), required to deposit security varying, according to the elevators, from 1 000 dollars to 25 000 dollars.

The writer next gives indications on the cost of handling grain in elevators, which is variable according to the amount of business transacted, as appears from the following figures :

| Number of bushels handled | | | Cost of handling per bushel (Cents) |
|---|---|---|---|
| from | 500 000 | to 100 000 . . . . . | 2.5 |
| ,, | 100 000 | ,, 150 000 . . . . . | 1.9 |
| ,, | 150 000 | ,, 200 000 . . . . . | 1.5 |
| ,, | 200 000 | ,, 300 000 . . . . . | 1.2 |
| ,, | 300 000 | ,, 400 000 . . . . . | 1.15 |

When farmers bulk their goods in their own elevators, they reduce the cost of handling, and therefore get higher prices for their grain. Probably farmer's elevators save those concerned about 1 000 000 dollars per annum in Minnesota.

The farmers utilise their elevators for the purchase of the different goods they need ; this business is of very great importance in Minnesota. In 1912-13 the purchases amounted to about 2 000 000 dollars, comprising coal, flour, food, etc. : 63 % of the elevators engaged in the purchase of coal, 41 % food, 40 % flour, 35 % binding string, 18 % seed, and 16 % salt. Business was also transacted relating to cement, agricultural implements, timber, fencing material (including iron wire fencing), and oil.

At the close, the Author gives advice as to the mode of organisation of a Society and a specimen of by-laws.

# PLANT DISEASES

## DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1027 – **Researches as to Injuries caused by Lighting-gas to Plants.** — SORAUER PAUL., in *Zeitschrift für Pflanzenkrankheiten*, Vol. 26, No. 3-4, pp. 129-183. Stuttgart, June 1, 1916.

At the request of the Berlin Gas Works the writer made experiments, the results of which are set out in the present work, on the damage caused to plants by lighting-gas. These experiments were conducted in the large parks of Berlin, which proved well adapted for the purpose.

The writer proposed in the first place to ascertain by experiment the character of the toxic effects due to lighting-gas. Hitherto the blue colouring of the roots was regarded as a satisfactory indication, but these experiments have made it clear that this phenomenon often gives a misleading result. Systematic experiments were begun in the spring of 1913, with *Prunus Padus*, *Ulmus scabra*, *Carpinus Betulus*, *Viburnum Opulus*, *Quercus pedunculata*, *Ulmus campestris*, *Urtica dioica*, *Syringa vulgaris* and a large number of ornamental plants.

In all plants suffering with gas poisoning it was observed in the first place that the chlorophyll was attacked, disappearing little by little. The process of assimilation and the formation of new organic substances, in spite of the presence of all factors of growth, are impeded in soil permeated with lighting-gas, and the plant utilises its own substance for intramolecular respiration. These phenomena indicate the existence of a process of asphyxia through the want of oxygen in the roots. If lighting-gas effectively acts on the roots, the consequence of intramolecular respiration also appears on the overground parts of the plant. That is why those parts of the leaf which receive the least sap (edges of the leaf) are the first to show discoloration or disappearance of the chlorophyll, and also why the first signs of withering (appearance of dry spots and edgings) appear on the edges of the leaf.

With the drying of the periphery of the green organs, and the reduction of evaporation, an excess of water is observed as a consequence in the lower parts of the stalk and roots of the plant. This phenomenon is noticed at

the point where the parenchyma has the most powerful reaction, namely in the bark. The consequence is often wet rot and death of the base of the stalk. This is the case of what is called " Lohkrankheit ", the cause of which is too large a supply of water through the roots.

Among the injuries caused to the leaves, the appearance of transparent spots rapidly spreading is characteristic in some large-leaved plants.

In an atmosphere of gas, transpiration falls off greatly for each gram of fresh substance. If the plants have an abundant amount of water at the time of reduction of the evaporation coefficient, a great accumulation of water takes place in the organs of transpiration. Under the influence of this accumulation it is observed in rapidly growing plants that the cells of the separation layer become gradually less coherent, and the result is the fall of the leaf (in *Fuchsia, Begonia* and *Azalea*). In *Taxus* and other trees, big lenticular swellings were observed on the roots in consequence of too large a water supply.

1028 - **Studies on " Dörrfleckenkrankheit " (Dry spot Disease) in Oats** (1). — SCHIKORRA W., in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 45, No. 18-25, pp. 578-586. Jena, June 19, 1916.

For the last two years it has been observed in Germany that growing trials of oats carried out in pots are liable to the appearance of a characteristic disease often producing death of the leaves. In 1913-14 the disease appeared to a limited extent only, not hindering the experiments, but such was not the case this year, the oats becoming diseased both in pots and in the open field ; therefore the causes of the disease had to be studied.

It was found to be the disease called " Dörrfleckenkrankheit " of oats by CLAUSEN-HEIDE ; it is distinguished by the fact that the leaves of the oats, after normal growth, show pale, greyish-yellow spots the tissues of which die, and the leaves break. The disease is known in Upper Bavaria under the name of " Haftersucht " and in Sweden under that of " Graufleckigkeit " of oats. The cause, according to NILSSON-EHLE, ERIKSSON, KRAUSE, etc. is *Scolecotrichum graminis*, but recent experiments have shown that typical " Dörrfleckenkrankheit " is a disease of the soil, often promoted by also manuring with artificial fertilisers.

The writer made experiments on the outbreak of the disease by studying the influence of manuring with artificial nitrogenous fertilisers : 5 experimental pots each containing 6 kg. of clayey-sandy soil were given a basal manure of 5.5 grms. of dipotassium phosphate, after which 0.5 gms. of nitrogen per pot was added. As nitrogenous manure there were used, by way of comparison with each other, pure nitrate of soda, sulphate of ammonia, urea, nitrate of urea, cyanamide, ammonium chloride, Rehmsdorf nitrogenous manure (organic nitrogenous manure), ammonium bicarbonate, and the double sulphate of ammonium and soda; 5 other pots received no nitrogenous manure and served as controls.

The observations made on the plants cultivated in these pots gave

(1) See also *B.* June 1914, No. 575. (*Ed.*)

a very different idea of the nature of the disease in each case. According to the degree of disease, the following results were obtained :

| | |
|---|---|
| Oats very badly attacked : | Rehmsdorf manure meal. |
| Oats badly attacked : | Nitrate of soda, urea, nitrate of urea, ammonium bicarbonate. |
| Oats clearly attacked : | Double sulphate of ammonia and soda, cyanamide, sulphate of ammonia. |
| Oats hardly attached at all : | Ammonium chloride. |

On adding 1 gram of nitrogen to the pots it was found that the nitrate of urea had given a better result than the nitrate of soda. According to the degree of the disease there is obtained :

| | |
|---|---|
| Oats very badly attacked : | Rehmsdorf manure meal, nitrate of soda. |
| Oats badly attacked : | Urea, ammonium bicarbonate. |
| Oats clearly attacked : | Nitrate of urea, cyanamide. |
| Oats weakly attacked : | Sulphate of ammonia, double sulphate of ammonia and soda. |
| Completely healthy oats : | Ammonium chloride. |

It will be seen from these facts that even the very best fertilisers may often be the most injurious to the plants.

The table of crops shows that the best yield was obtained through ammonium chloride, because it checked the progress of the disease, while the best nitrogenous manure, nitrate of soda, gave a less satisfactory result. It should be noted that at the beginning of growth, before the onset of the disease, the plants manured with ammonium chloride were not the best in appearance, but later on there was a change in this.

The writer has also studied the influence of various potassic and phosphatic manures and lime on the " Dörrfleckenkrankheit », by manuring pots with doses of these fertilisers. The experiments were continued for 5 consecutive years. They showed that a heavy lime manure had assisted the onset of the disease.

In another series of experiments the writer mixed the ordinary light soil of a field successively with marsh soil, marl, clay and straw, and then studied the relations between these additions and the outbreak of the disease.

On the plot which had received marsh soil the oats were most clearly attacked ; on those which had received marl and on the control plots the disease was not so strong ; on the plots which had been given straw manure the plants showed but few spots ; finally, on the plots which had received clay the plants were hardly attacked at all. These observations agree with those obtained by CLAUSEN, TACKE, HUDIG and ZIMMERMANN on ordinary sandy, marshy and clayey-silicious soil. It is difficult to give a precise explanation of this phenomenon, but probably the temperature of the soil plays a part, a high temperature being favourable to outbreak of the disease.

As regards the relations between artificial fertilisers and the appearance of the disease, the writer concludes that the disease is promoted by physio-

logically alkaline manures such as Chilean nitrate, basic slag and lime. It may therefore be controlled by manures with a physiologically acid reaction, such as ammonia, potash salts and superphosphate. This hypothesis is born out by the writer's experience of soils that are most favourable to the disease.

It is intended to continue the experiments.

1029 – **The Possibility of Recovery of the Slips of a Vine suffering from "Bramble-Leaf"** (1). — PANTANELLI E., in *Le Stazioni sperimentali italiane*, Vol. XLIX, Part 5-6, pp. 249-296. Modena, 1916.

Experiments carried out for the purpose of ascertaining:

1) Whether the wood taken from vines suffering with "Bramble-leaf (court-noué" or "roncet") produces in all cases plants and vines showing the same disease;

2) Whether vine plants affected with bramble-leaf can be cured by suitable treatment or under favourable conditions of growth;

3) Whether such recovery is real and durable or apparent and transitory.

In the course of these experiments the following facts were brought to light:

Slips taken from vines affected with this disease and planted in any soil began their spring growth by forming buds which exhibited bramble-leaf.

The disease of the shoots, slips or plants consisted mostly in deformation of the leaves (laciniation, twisting of the toothed edges, spotting in the case of Riparia and Rupestris, asymmetry and formation of blisters on the leaves in Berlandieri) and in a strongly pronounced internodal distortion of the branches. In the spring, above all in the case of Rupestris, Riparia, 420 A, the leaves showed pale or blackish spots, but never to the same extent as in the parent vines suffering with mosaic bramble-leaf. Leaves which had grown from the month of May onwards, although deformed, were generally without these spots, which sometimes reappeared on the last leaves the growth of which had taken place at the end of autumn (November-December): they then also appeared on some of the last leaves of plants remaining healthy in appearance. These symptoms are identical with those produced by rapid falls of temperature during the formation of the buds.

The slips taken from vines attacked by bramble-leaf often recover in the course of growth; precisely the same thing, for that matter, is observed in the parent vines, that is to say, after a first stunted development the branches form internodes which grow continually longer and end by being of normal form; the leaves were less and less deformed and their shape and dimensions at last became normal.

It is a rare thing for slips taken from vines suffering with bramble-leaf not to have stunted buds suffering from the disease at the outset. When this case did occur, especially in Berlandieri and its hybrids as well as the European-American crosses, it is explained by the fact that the slip has been taken from the non-diseased tip of a branch.

(1) See also *B.* July 1914, No. 684. (*Ed.*)

As a general rule, the disease is reproduced on the first buds of the slip, with the same intensity and the same appearance as it had exhibited in the previous year on the corresponding leaves and the internodes of the branch of the parent vine.

Furthermore, the experiments described in this work have brought out a number of shades and gradations of this phenomenon of preservation of bramble-leaf in the layer-slips so much so as to point to the possibility of an effective, slow and gradual cure of plants taken from diseased vines.

The slips of the Berlandieri and their hybrids, the European-American hybrids and Riparia, above all, recovered more rapidly during the summer than the slips of Rupestris, and among the latter varieties the most liable to the disease are the most difficult to cure. For instance, the proportion of plants which recovered in summer, all conditions of soil and rearing being equal, is less in the case of the varieties of Rupestris du Lot than of Rupestris metallica.

Furthermore, the more readily the diseased slips take root in a given soil, the more easily they recover. The recovery which occurs in summer is proportional to the root growth, in respect both to the number and thickness of the roots put forth by the slip. It follows rather than precedes the production of root apparatus sufficing for the needs of the aerial portion. The question involved therefore is that of an abundance of roots relatively to the size of the slip. For instance, a plant with fine stalk recovers in summer even if it has only few roots, while a slip as thick as those often taken at the base of branches, needs the growth of numerous roots before equilibrium is established between the demands of the foliage and the potentialities of the absorption apparatus.

Whatever the factor influencing the production of roots, it also influences the recovery of the diseased branches in summer. Thus the treatment of the slips with different baths at the time of planting very much facilitated their recovery, not owing to any disinfecting action, but because some of the substances applied stimulated exchanges favourable to a greater root production. In 1907 the best results were obtained with ferrous sulphate, phenol and hot water; in 1908, with phenol, ferrous sulphate and hot water; in 1909, with formalin, phenol, acids and hot water; in 1910, with ferrous sulphate, sulphuric acid and lysol.

The difference observed between the behaviour of diseased slips planted on propagation beds already partly exhausted by use and those planted on beds which had been fallowed, was still more interesting. In the latter case the diseased slips at once formed a strong root system, while in partly used up soil the diseased slips struck root very poorly, and in summer there was little or no recovery.

The writer has made trials of different crops with a view to finding out which is most adapted to rest the fatigued soil for the purpose of vine-growing; leguminosae contributed largely to better rooting of the slips, and on the beds where bean ensilage had been carried out the proportion of recoveries in summer was usually found to be higher.

| | Exhausted propagation bed | | | | Fallowed propagation bed | | | |
|---|---|---|---|---|---|---|---|---|
| | Slips planted (diseased) | Branches | | | Slips planted (diseased) | Branches | | |
| | | healthy | cured | diseased | | healthy | cured | diseased |
| Rupestris du Lot . . . | 2 000 | 0 | 395 | 276 | 1 000 | 48 | 213 | 126 |
| » metallica . . | 1 000 | 45 | 229 | 136 | » | 86 | 294 | 48 |
| Riparia Gloire . . . . | » | 40 | 289 | 143 | » | 123 | 338 | 27 |
| 3309 . . . . . | » | 65 | 194 | 115 | » | 158 | 282 | 36 |
| Aramon × Rup. G . . . | » | 72 | 234 | 179 | » | 163 | 396 | 62 |
| Berlandieri R. 1. . . . | » | 0 | 0 | 10 | » | 20 | 39 | 13 |
| » » 2. . . . | » | 3 | 44 | 42 | » | 37 | 129 | 17 |
| 420 A . . . . . | » | 0 | 18 | 27 | » | 49 | 246 | 20 |
| 1737 . . . . . | 800 | 22 | 108 | 124 | » | 73 | 348 | 42 |

It remains to be seen whether this recovery taking place in the summer is only temporary, or whether in reality the vines infested with bramble-leaf tend to recover in the course of time; 200 affected slips of Rupestris du Lot taken from the nursery bed of Noto (Sicily), were planted in 1909 at Trobaso, near Lake Maggiore, in a soil which had before been put down to vine. In the spring of 1909 there were rather frequent late frosts there, and the already developed and barely opened buds remained covered with snow for a week. The first shoots which came out were very much curled, but in the summer the branches recovered completely. In the following year, 1910, the spring buds were still slightly deformed, but the vines showed vigorous growth in the summer. In 1912 not the slightest trace of bramble-leaf could be discovered any longer, and the growth was extremely vigorous.

This result would seem to prove that slips suffering with "court-noué," even those of the most sensitive stock, such as Rupestris du Lot, can recover from this disease in a few years if placed under conditions entirely favourable to their taking root.

## DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

### GENERALITIES.

1030 – **New Species of Parasitic Fungi discovered in Canada.** — Dearness John., in *Mycologia*, Vol. VIII, No. 2, pp. 98-107. Lancaster, Pa., 1916.

Among the species described the following deserve particular mention:

1) *Placosphaeria cornicola* n. sp., on the living leaves of *Cornus Nuttallii* Aud., in the island of Vancouver (British Columbia), September 1914; the diseased parts take on a bright red and afterwards a yellow colour while many black stromata appear and tend to run together; 2) *Cytodiplospora*

*parallela* n. sp., on *Acer nigrum* Michx., at Byron (Ontario), October-November 1903; stromata containing 5 to 15 pycnidia, scattered irregularly or arranged in more or less continuous parallel lines; 3) *Ascochyta Achlydis* n. sp., on *Achlys triphylla* D. C., in the island of Vancouver, 9th June 1915; on the leaves attacked spots are observed, some of which are small in size (2 mm.); others, fewer in number, are 1 cm. in diameter and have a dark red border; 4) *Diplodia Nuttalliae* n. sp. on *Nuttallia cerasiformis* Tovr. and Gr., at Victoria (British Columbia), April 1915; the pycnidia are placed round the lenticels, which likewise serve as a passage for the parasite; 5) *Septoria adenocaulonis* n. sp., on leaves of *Adenocaulon bicolor* Hook, in British Columbia, May 1915; 6) *S. angularis* Dearness and Bartholomew n. sp., on leaves of *Solidago latifolia* L. at Komoka (Ontario), June 1913; 7) *S. lupincola* n. sp., on leaves of *Lupinus perennis* L., at Oakland, near London (Ontario), July 1915; 8) *S. sanguinea* n. sp., on *Ribes sanguineum* Pursh, in British Columbia, September 1912; 9) *S. Macrosporia* n. sp., on *Chrysanthemum Leucanthemum*, at London, October 1915; 10) *Leptostromella conigena* n. sp., on cones of *Picea Abies* (L.) Karst., at London, April 1915; 11) *Melanconium parvulum* Dearness and Bartholomew n. sp., on dead branches of *Betula populifolia* Marsh, along the south-eastern shores of Lake Huron (Ontario), May 1912.

Further mention is made of *Cylindrosporium Crataegi* Ellis and Ev., on leaves of *Crataegus brevispina* in British Columbia, September 1914; *C. Toxicodendri* (Curtis) Ellis and Ev. on living leaves of *Rhus Toxicodendron*, etc.; *Ramularia Lapsanae* (Desm.) Sacc., on *Lapsana communis* L. at Elgra (Ontario), July 1915, etc.

MEANS OF PREVENTION AND CONTROL

1031 - **Seed Sifting as a Means of Controlling Fungous Diseases.** — HENNING ERNEST., in *Kungl. Landtbruks-Akademiens Handlingar och Tidskrift*, Lth. Year, No. 4, pp. 282-300. Stockholm, 1916.

According to ZIMMERMANN, the mycelia of certain parasitic fungi may retain their vitality for five years in the seeds of grass plants. The writer had satisfied himself a long time ago that the appearance of *Ustilago Tritici* was clearly related to the time and conditions of flowering. While it occurs very rarely on *Hordeum distichum erectum*, with close ear, which during the phase of fertilisation keeps its flowers entirely enclosed in the glumes, it is on the other hand very frequent in *H. distichum nutans*, with loose ear and in which at the time of fertilisation the flowers at the tip and sometimes those at the base of the inflorescence open. At that moment, the numerous spores of *Ustilago* carried by the wind penetrate the floral organs, grow and take up their abode in the mass of the grain. For loose-eared varieties of barley therefore it would be desirable to remove these infected grains at the time of sowing. A feature by which they may be distinguished is their size. The grains inserted at the tip and at the base of the inflorescence are distinguished by smaller bulk, and between the bulk of the grains and the percentage of infected plants, as the Author was able to prove by many experiments, the following inverse ratio exists:

(*Ustilago nuda*).

| Length of grains in mm. | 2.0 | 2.25 | 2.50 | 2.75 | 3.0 |
|---|---|---|---|---|---|
| Percentage of infected plants | 3.2 % | 4.6 % | 1.9 % | 1 % | 0.1 % |

The choice of bulky grains also allows of reducing the number of plants infested with *Helminthosporium gramincum*, as results from the following data:

| Length of grains in mm | 2.0 | 2.25 | 2.50 | 2.75 | 3.0 |
|---|---|---|---|---|---|
| Percentage of infected plants | 42.5 % | 43.2 % | 35.6 % | 24.4 % | 13.3 % |

Experiments conducted at Ultuna have shown that oat plants grown from small seeds are more liable to attack by *Puccinia graminis*.

From the foregoing it follows that the sifting of seed may in many cases furnish a method calculated, not perhaps to get rid completely of the germs of certain diseases, but at any rate to diminish to a notable extent the percentage of infected plants.

1032 – **Economic Data relating to the Treatment of Potatoes with Bordeaux Mixture against *Alternaria Solani*.** — See No. 1014 of this *Bulletin*.

1033 – ***Diplodia Zeae*, the Cause of Dry Rot in Maize.** — VAN DER BIJL PAUL A., in *Union of South Africa, Department of Agriculture, Division of Botany and Plant Pathology, Science Bulletin* No. 7, pp. 1-60, Pl. 1-15. Pretoria, 1916. DISEASES OF VARIOUS CROPS

The disease known by the name of " dry rot " in maize is produced by the fungus *Diplodia Zeae* (Schw.) Lev., reported so far in Europe, America, Australia, and at various points in South Africa.

One of the most conspicuous symptoms of the disease is the appearance of a dense growth of whitish mycelium, which develops in the furrows between the caryopses, makes its way to the centre of the bracts, surrounds the filamentous stigmata and forces them against the internal face of the bracts — which become discoloured, — and afterwards forms round the ear a large dry envelope, formed by the hyphae of the fungus.

The caryopses of the diseased ears are stunted and light in weight, dark in colour, and are easily detached. The colourless segmented hyphae, of a breadth of from 1.15 to 3.08 μ are not capable of perforating the cell partitions, but they generate into the interstices of the cells and vessels through the areolae. The mycelium in itself is not distinguished from other fungi (*Fusarium* spp.) parasitic on maize. On the other hand, a characteristic of the genus *Diplodia* is the small black pycnidia which usually grow on the edge of the alveolae, as may easily be seen on breaking the diseased ear across. They are however also found embedded in the mycelium on the caryopses and bracts, and sometimes even in the culm, near the nodes or at a point corresponding to some lesion.

The shape and size of the pycnidia vary greatly ; they may be pear-shaped (from 187.5 to 337.5 μ), ellipsoid (150 × 330 μ), spherical or spheroidal (from 200 to 275 μ). The wall of the pycnidium is formed of two layers of cells, and on its internal face grow the hymenium and the spores, bilocular (rarely trilocular), straight or slightly curved, cylindrical, brownish-black

and of variable dimensions: 19.8 — 33 × 4.95 — 6.6 μ. The conidiophores are unicellular, colourless, with rich content of protoplasm and measure 6.16 — 10.75 × 1.54 — 1.55 μ. The spores are of low resistance power, and although they are able to pass through the alimentary canal of animals without undergoing apparent deterioration, their vitality is nevertheless greatly impaired; exposure to the sun delays their germination; the germination capacity dies out entirely in spores one year old. The writer has studied the growth of spores under anaerobic conditions, with various degrees of alkalinity and acidity, after exposing them for 2 hours to the action of freezing mixtures. In plain agar the fungus grows little. On the other hand, if a little oat flour is added to the agar a rich growth occurs. Among the fungicides examined the best results were obtained with lithium salts, which stop the growth of the mycelium and prevent the germination of the spores.

As means of control against dry rot it is advised: 1) to remove from the fields and destroy by fire all vegetable residue which, if left there, would become centres of infection; 2) to discontinue maize-growing for some years in the infected zones, and also in the adjoining fields.

As was stated above, the diseased caryopses are distinguished by their light weight which is brought out clearly by the following table:

| | Weight of ear without bracts | | Length of ear | | Weight of caryopses | | Weight of rachis | |
|---|---|---|---|---|---|---|---|---|
| | healthy | inoculated | healthy | inoculated | healthy | inoculated | healthy | inoculated |
| | g | g | cm | cm | g | g | g | g |
| 1 | 252 | 154 | 19 | 18 | 210 | 96 | 42 | 56 |
| 2 | 294 | 252 | 19.5 | 23 | 224 | 162 | 84 | 70 |
| 3 | 224 | 196 | 18.5 | 18.5 | 168 | 154 | 70 | 42 |
| 4 | 238 | 182 | 19 | 19 | 196 | 140 | 84 | 42 |
| 5 | 238 | 196 | 18.5 | 17 | 182 | 140 | 56 | 56 |
| 6 | 322 | 252 | 20.5 | 21.5 | 252 | 196 | 70 | 56 |
| 7 | 392 | 294 | 23 | 22 | 308 | 224 | 84 | 70 |
| 8 | 336 | 210 | 21.5 | 23.5 | 266 | 196 | 56 | 42 |
| Average per ear | 287 | 217 | 19.687 | 20.312 | 225.75 | 163.5 | 66.25 | 54.25 |

The average loss of weight of the caryopses is therefore 27.8 %, and, in serious cases, it may even amount to 50 %.

The alteration of the grains is due largely to the action of a diastatic enzyme secreted by the mycelium of *Diplodia*, which attacks and destroys the embryo and the starch grains.

Another enzyme afterwards separates the fatty substances, which accounts for the reduction in the fat content in the infected maize. When fed to livestock the latter does not cause any poisoning but the deterioration in its composition really does not make it a food to be recommended.

1034 - **Researches on the Silver-scurf Disease (*Spondylocladium atrovirens*) of the Potato** (1). — SCHULTZ S. EUGÈNE, in *Journal of Agricultural Research*, Vol. VI, No. 10, pp. 339-350. Pl. XLV-XLVIII. Washington, D. C., 1916.

The researches made in connection with the potato disease known as "silver scurf", and caused by *Spondylocladium atrovirens* Harz., show that in spite of the great differences in the size of the spores (which had led some writers to assume the existence of two different species, with macrospores and microspores), there really exists only a single species. This follows clearly from the fact that by cultivation in pure lines (namely, from a single spore) conidia are obtained measuring from 18 to 64 μ. *S. atrovirens* exhibits a negative heliotropism, which does not materially affect the development and appearance of the infection.

In agar cultures the conidia and mycelium withstand the most intense desiccation without being affected. The thermal optimum lies between 21° and 27°, the maximum amounts to 30° C ; as regards the minimum, growth ceases at 2°-3° C, death only occurs at — 10° C.

Neutral or slightly acid media are thus apparently most adapted to bring about the growth of the fungus. The presence of 5 per cent of saccharose in the agar prevents the formation of the spores.

The parasite enters the tubers through the lenticels, and its mycelium over-runs the epidermis and the more superficial layers of the bark, which it breaks up, producing lesions of various kinds. The epithelium breaks away in the form of silvery scales (" silver-scurf ") The nutritive value of the potatoes is not diminished, but their marketable value is very much depreciated.

The infested potatoes readily carry the disease from one place to another, and in the same locality they carry it over from one season to another ; the mycelium, the conidia and sclerotia retain their vitality for a long time, and as soon as the degree of humidity and temperature allow, they grow and develop rapidly.

As active means of preventing the spread of the disease the following are advised : 1) treating the infected tubers with a hot solution of 1 % mercuric chloride ; 2) maintaining a very low temperature in the places of storage ; 3) discarding even slightly infected potatoes when sowing.

1035 - **Tobacco Diseases and Pests in Eastern Java.** — See No. 967 of this *Bulletin*.

1036 - ***Diplodia* sp., a Melon Disease in the United States.** — MEIER F. C., in *Journal of Agricultural Research*, Vol. VI, No. 4, pp. 149-152, Pl. XVII. Washington, D. C., 1915.

According to the facts reported in this preliminary notice, fruit dealers in the United States have in the past few years had heavy losses in consequence of a disease attacking melons (*Citrullus vulgaris*) in railway trucks and sometimes destroying a large part of the goods or rendering them unsaleable before they reach their destination.

The first symptom of the disease is a slight discolouration of the rind, which starts at the stalk and finally involves almost the entire surface of

(1) See also *B.* Sept. 1913, No. 1105 and *B.* Nov. 1914, No. 1070. (*Ed.*)

the fruit. The tissue of the rind then softens and shrinks, the pulp becoming black and gelatinous.

The writer was able to isolate and cultivate the pathogenic agent. It consists of a species as yet unidentified, belonging to the genus *Diplodia*; the diagnosis was confirmed by the entirely positive results of a series of artificial inoculations.

The fungus has separate or adjacent pycnidia, which may or may not be covered with a network of hyphae from 180 to 250 μ in diameter; the spores are oval, 24-30 × 10-14 μ, brownish-black and segmented. In the matter extracted from artificially inoculated melons the presence of paraphyses was not observed; the latter developed on cultivating the fungus on cylinders of potato.

In the United States the principal crops attacked by *Diplodia* are the sweet potato, *Citrus* fruits, maize and the cotton tree. As, in the South, cotton fields, sweet potato and melon fields are not separated from each other, it was of interest from the economic point of view to ascertain whether a species of *Diplodia* found on the one host is capable of development on another also. Experiments in this direction yielded positive results: a culture of *D. tubericola* E. et E., inoculated into healthy melons produced a series of symptoms identical with those described above.

1037 – ***Sclerotinia libertiana*, a Disease of Citrus and Other Plants Cultivated in California.** — Smith O. Clayton, in *Phytopathology*, Vol. 6, No. 3, pp. 268-278. Fig. 5, Baltimore, Md., 1916.

The citrus disease known under the name of "white mould" or "cottony rot" is very frequent in California, in storage places of citrus fruits during the period January to March. Besides the fruits of the lemon tree, it also attacks the small branches of orange trees and lemon trees in the plantation, and likewise, but more rarely, the flowers of the lemon tree. The pathogenic agent is supposed to be *Sclerotinia Libertiana* Fuckel. The pathological changes observed on the fruits is characterised externally by an abundant white growth of mycelium of cottony appearance, and internally by a progressive softening which converts the tissues into a soft mass. The disease spreads rapidly, and all the lemons contained in one case are soon infested, and form a dangerous centre of infection in the store house. The bark of the small branches of the plants growing in the open air or under glass becomes ashy in colour and fibrous in consistency, and gum exudes plentifully all around the infected plant. *Scl. Libertiana* can likewise develop in the flowers, where excellent conditions are available in the thick mass of the petals at the beginning of flowering.

This fungus not only attacks *Citrus* spp. but also the flowers of the apricot, the small branches of the alligator pear tree (*Persea gratissima*), cucumber, tomatoes, vetches, lettuce, nettles, egg-plants, etc.

The practice prevailing in California of sowing vetches in citrus plantations must have contributed greatly to the spread of the disease.

It is also easy to produce artificial infection of the disease on lemons in a wet environment, by means of applications or inoculations of mycelium, sclerotia, spores or fragments of apothecia of the fungus. In this respect

the results were always positive, even when substances of different source and origin were used, isolated in several parts of the United States from the different hosts of the parasite.

Cultures of lucerne affected with *Scl. Trifoliorum* also causes rotting of the fruits of the lemon tree, which, however, instead of turning straw yellow as in the other cases, assumed a nut-brown colour.

As means of control it is advised to wash the citrus fruits with an 0.02 per cent. solution of sulphate of copper.

1038 - **Black Rot of the Vine (*Guignardia Bidwellii*) Attacking *Vitis rotundifolia* and *V. Munsoniana* (Muscadine Grapes) in the United States of America.** — See No. 987 of this *Bulletin*.

1039 - ***Hypoderma deformans* n. sp., Attacking the Leaves of *Pinus ponderosa* in the United States and Canada.** — WEIR JAMES R., in *Journal of Agricultural Research*, Vol. VI, No. 8, pp. 277-288, Fig. 1-4, Pl. XXXII. Washington, D. C., 1916.

The writer describes as a new species, under the name of *Hypoderma deformans* n. sp., a fungus which attacks the leaves of *Pinus ponderosa* Laws. in several parts of the United States and Canada : Montana, Oregon, Idaho, Washington and British Columbia.

The black, glossy apothecia, 10 mm. in length and about 1 mm. in width, may develop in the form of a continuous or broken band over the entire length of the leaf; the asci are spindle-shaped, the spores olive green in colour, transparent, slightly curved, with blunted tip, and have a septum on reaching maturity; the paraphyses are numerous and thread-like, slightly swollen at the tip.

The end of the infected leaves turns yellowish brown, and this change spreads more or less rapidly throughout the leaf until the final appearance of the apothecia. The exact length of time between the first symptoms of the disease and the ripening of the apothecia varies greatly, being sometimes April-May to November ; it is occasionally prolonged until the following spring. The apothecia may contain asci in all stages of development, so as to produce ripe spores continually. The period of most intense spore formation, however, is found to be in May and June, when rains are frequent and when the plants have attained their maximum active growth. The leaves attacked end by withering completely and falling, which causes many troubles and changes in the growth of the buds. One of the most conspicuous phenomena consists of the appearance of very large " witch's brooms " of a diameter of 1-2 yds and a weight exceeding one cwt. The formation of these witch's brooms had been erroneously attributed to *Razoumofskya campylopoda* (Engelm.) Piper (" yellow-pine mistletoe "), but they are certainly connected with the presence of *Hypoderma deformans*. The branches thus deformed are generally sterile.

The disease not only attacks plants which have already attained a certain growth, but also young nursery plants, causing the death of the latter when the attack is very severe.

## WEEDS AND PARASITIC FLOWERING PLANTS.

1040 – **"Witch Weed" or "Rooi-Bloem" (*Striga lutea*), a Phanerogam parasitic on Maize in Rhodesia.** — WALTER J. A. T., in *The Rhodesia Agricultural Journal*, Vol. XIII, No. 2, pp. 234-236. Salisbury, 1916.

The appearance of "witch weed" or "rooi bloem" (*Striga lutea*) has been reported in the valley of Mazoe; its occurrence is recognised by the scarlet colour of the inflorescence and the reduction in the foliage. It attaches its roots to those of maize and deprives its host of a considerable quantity of sap, hindering its growth and sometimes preventing the formation of the ear.

*S. lutea* spreads rapidly, and is capable of destroying within a short time, throughout entire districts, the crop of maize, this being the only cultivated plant which is the host of the parasite. In consequence of this fact control experiments were carried out by means of appropriate rotations, but the result of these trials was negative, owing to the persistence of the *Striga* seeds, which are capable of retaining their vitality for many years in the soil.

The only practical remedy is to pull up the *Striga* plants and destroy them by fire as soon as they appear on the surface of the soil.

1041 – **Khaki Weed (*Alternanthera Achyrantha*) in Queensland.** — BAILEY J. F. and WHITE C. T., in *Queensland Agricultural Journal*, New Series, Vol. V, 5th Part, pp. 277-278, Fig. 1. Brisbane, 1916.

A description of the "Khaki weed" (*Alternanthera achyrantha* R. Br.). It was imported from Argentina to Africa in forage during the Boer war. It was introduced into Australia, first invading New South Wales and afterwards extending to Queensland.

1042 – **Cut-leaved Nightshade (*Solanum triflorum* Nut.) and London Rocket (*Sisymbrium Irio*). New Weeds in New South Wales.** — HAMILTON A. A., in *Agricultural Gazette of New South Wales*, Vol. XXVII, 4th Part, pp. 275-276. Sydney, 1916.

"Cut-leaved nightshade" (*Solanum triflorum* Nut.) a solanaceous plant reported in the district of Cooma. The berries and overground parts of the plant, which contain solanine, are poisonous.

"London Rocket" (*Sisymbrium Irio* L.) a crucifer met with in the environs of Cobar and Nyngan. The plant was probably introduced with lucerne seeds. It has no injurious properties, but in view of the rapidity and intensity with which it spreads in lucerne fields, replacing the crop, *S. Irio* is regarded as a weed.

1043 – ***Agrostemma githago* among Cereal Grains: Determining the Coefficient of Impurity.** — See No. 968 of this *Bulletin*.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

MEANS OF PREVENTION AND CONTROL

1044 – **Experiments in Locust Control by Means of *Coccobacillus acridiorum* in Argentina** (1). — KRAUS RUDOLF, in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 45, No. 18-25, pp. 594-599. Jena, June 19, 1916.

The writer first gives a description of *Coccobacillus Acridiorum* discovered by FELIX D'HÉRELLE in Mexico in 1909. He then refers to the control experiments conducted by D'HÉRELLE himself in Mexico, and finally he mentions the observations made on this bacterium in Colombia, South Africa and Argentina.

In Argentina, the Ministry of Agriculture has appointed a Commission, of which the Author is a member, the object of which was to repeat the experiments of D'HÉRELLE and draw up a detailed report on the results obtained. The Commission had at its disposal cultures coming direct from the Pasteur Institute and which, according to bacteriological investigations, corresponded perfectly to the *Coccobacillus* of D'HÉRELLE.

D'HÉRELLE described this *Coccobacillus* as a micro-organism having few typical characters. For that reason the Author thought it necessary to determine in the first place whether in the intestine of locusts there are no micro-organisms resembling the *Coccobacillus* of D'HÈRELLE. He was able to isolate from the intestine of the healthy insect organisms which are morphologically identical with the *Coccobacillus*, which led him to suppose that this latter is usually present the intestine of the locust.

For the purpose of successful control of locusts in the open field, a virulent culture is required, according to D'HÉRELLE, who says that before beginning the experiment the virulence must be checked to see whether it is sufficiently effective. Unfortunately no criterion of virulence is indi cated.

He only says that 12 passages through locusts are sufficient to give the cultures the necessary virulence.

The virulence was determined by the writer by means of a normal loop. The culture used first had a virulence of 1/200 loop, and later, after passing through the locusts, a virulence of 1/2000 loop. The virulence of this culture remains unchanged for a long time. The writer not only increased the virulence of the *Coccobacillus* of D'HERELLE, but also found that the same effect may be equally well obtained in relation to the micro-organisms isolated from the intestine of locusts.

After checking the virulence the Author made experimental infection with *Coccobacillus* in the laboratory, giving infected foods to the locusts. Contrary to the observations of other experimenters, he ascertained that these insects, even in captivity, will take fairly large quantities of food. The experiments, however, were negative in result, even when large rations of infected food were given.

(1) See also *B.* April 1913, No. 750. (*Ed.*)

The writer next made experiments in the open field with young insects. With this object he selected localities liable to invasion and distinguished by good climate and abundant herbage. For the purposes of the experiments the plots were surrounded by a zinc band, as is done for mechanical methods of control. The bacterial culture was spread over several plots containing young locusts, but without success. In no case was any endemic destruction of the insects observed in consequence of the treatment. Even in one case where 200 insects afterwards placed on the plot were artificially infected, the results obtained were negative.

The writer draws the following conclusions :

1) It is not possible to produce in the open field the epidemic infection and the death of young locusts by spraying with a culture of *Coccobacillus* the virulence of which has been increased by successive passages;

2) It may thus be concluded that this *Coccobacillus* is a normal inhabitant of the intestine of healthy locusts, and that it only kills the latter when injected into the abdominal cavity;

3) By administering this bacterium to young locusts with food, no infection is obtained.

1045 – ***Spicaria Cossus*** **n. sp., a Hyphomycete isolated from the Larva of "Cossus Rongebois" (*Cossus Cossus*).** — PORTIER PAUL and SARTORY, in *Comptes rendus des séances de la Société de Biologie*, Vol. LXXIX, No. 14, pp. 700-701, Fig. Paris, July 22, 1916.

In nature, beneath the bark of various trees there are often found in the larval tunnels, mummified larvae of *Cossus cossus* (1) invaded by a pinkish-white fungus resembling silkworm larvae which have died from " muscardine ".

On killing a larva of *Cossus* and keeping it under suitable conditions of humidity, the same pinkish-white fungus is seen to develop in its tissues.

The writers, who have made a study of this fungus on several specimens of caterpillars taken wild or reared in captivity, describe it under the name of *Spicaria Cossus* n. sp.

1046 – **A Form of *Botrytis bassiana*, Isolated from the Larva of the Macrolepidopteron *Nonagria typhae*.** — PORTIER PAUL and SARTORY in *Comptes rendus des séances de la Société de Biologie*, Vol. LXXIX, No. 14, pp. 702-703. Paris, July 22, 1916.

The larva of *Nonagria typhae* lives inside the stalks of *Typha latifolia* devouring the pith.

On killing one of these caterpillars and keeping it in a sufficiently moist place, it is seen to mummify and become covered with a whitish coating made up of the fructifications of *Botrytis*.

From the morphological point of view, it is not possible to differentiate the *Botrytis* on *Nonagria* from *B. Bassiana* ; on the other hand, the different biological characters which the Authors have been able to ascertain do not appear to them sufficient to constitute the *Botrytis* on *Nonagria* a new species.

(1) See *B.* Jan. 1913, N° 88 and Jan. 1915, N° 131. *Ed.*)

1047 - **The Successful Treatment with Insecticides of Plants in Flower.** — See No. 963 of this *Bulletin*.

1048 - **Insect Pests of the Sugarcane in Queensland, Australia.** — JARVIS EDMUND, in *Queensland Bureau of Sugar Experiment Stations, Division of Entomology, Bulletin* No. 3, pp. 48, Pl. I-IV. Brisbane, 1916.

INSECTS INJURIOUS TO VARIOUS CROPS

List of insect pests of the sugar-cane in Queensland, accompanied by particulars as to the nature and extent of the damage sustained and the habits and distribution of these insects.

1) The " noctuid moth borer " (*Phragmatiphila truncata* Walk. — fam. *Noctuidae*), caused extensive injury to plantations in October 1914; the larvae make their way into the young shoots and still tender buds, mine tunnels and partly destroy the tissues; they cause a rapid drying up of the foliage. Natural enemies are : *Pheidole megacephala; Apanteles nonagriae* which kills the larvae, and *Euplectus howardi* which destroys a large number of pupae; 2) Moth stalk borer (*Diatraea saccharalis* Fabr. — fam. *Crambidae*) : this insect, so greatly feared elsewhere, hardly causes any injury in Queensland, where climatic conditions and natural enemies impede its development; 3) Beetle borer (*Rhabdocnemis obscurus* Boisd. — fam. *Curculionidae*), has established itself in the district of Johnstone River, where it destroys some thousands of tons of cane every year; for control, a tachinid fly, which is its natural enemy, was recently introduced into the region, namely, *Ceromasia sphenophori* Vil., discovered in New Guinea and already tried with success in the Fiji Islands; 4) Moth shoot-borer (*Polyocha* sp. — fam. *Pyralidae*), which is rather rare; the writer met with it in November at Pyramid, where it attacked the young shoots in the same way as *Phragmatiphila*; 5) *Opogona glycyphaga* Meyr. (fam. *Tineidae*) occasionally attacks the seed beds and sometimes destroys up to 80 % of the buds; also gnaws the leaf sheaths and the bark, and at times makes its way inside the cane and tunnels its walls; 6) *Loxostoma* sp. (fam. *Tineidae*) and *Cosmopterix* sp. (fam. *Elachistidae*) are unimportant; 7) Black gauger (*Heteronychus* sp., fam. *Scarabaeidae*); set eater (*Pentodon australis* Blackb. — sub-fam. *Dynastides*) and white ant (*Termes meridionalis* — fam. *Termitidae*), only occasionally injure the sugar cane, which they gnaw, and attack the newly opened buds and young plants; 8) Wireworm (*Monocrepidius* sp., fam, *Elateridae*) seriously attacked new seedlings on the alluvial plains of Mackay and in some other localities of the district of Isis in 1910; 9) Yellow winged locust (*Locusta danica* Linn., fam. *Acridiidae*) invaded the western and northern provinces of Queensland in 1912 in huge swarms; they devoured the leaves in the plantations and partly destroyed the crop; among their natural enemies there are noted *Scelio australis* and *S. ovi* parasitic on the eggs; 10) Large mottled locust (*L. australis* Brunner) is, like the last-named species, common in the coast region of Queensland and New South Wales; 11) Long-nosed locust (*Atractomorpha crenaticeps* Blanch.); short-horned locust (*Oxya velox* Fab.); *Cyrtacanthacris* (?) *proxima* Walk.; *C. plagiata* Walk.; *C. guttulosa* Walk., all belonging to the family Acridiidae; these insects occur in the cane plantations of Queensland, but so far have not occasioned any great damage; 12) Army worm (*Cirphis unipuncta* Haw., fam. *Noctuidae*), wrought

great havoc in 1912 in the districts of Cairns and Mossman ; 13) Skipper butterfly (*Paruara mathias* Fab., fam. *Hesperidae*), the larvae of which were seen gnawing the leaves of the canes at Harvey's Creek in December 1914 ; 14) *Telicota augias kreffti* Macl. (fam. *Hesperidae*) and *Padraona marnas* Feld. (fam. *Hesperidae*), the larvae of which were sometimes observed in the plantations at Babinda ; 15) Grass worm (*Chusaris rhodias* Turner, fam. *Noctuidae*) attacked leaves at Gordonvale on the 2nd September 1914 ; 16) Web worm (*Harmologa miserana* Walk. (?), fam. *Tortricidae*), at Pyramid, towards the end of October 1914, was observed on the rhizomes of the cane ; 17) Browntail moth (*Euproctis holoxutha* Turner, fam. *Liparidae*), occasionally attacks the foliage ; 18) Plant eating beetle (*Rhyparida morosa* Jac., fam. *Chrysomelidae*); its usual host is assumed to be blady-grass (*Imperata arundinacea*), which, however, is disappearing little by little owing to the extension of cultivation ; the insect, thus forced to seek its food alsewhere, began to attack the sugar cane ; the savanna and heath fires, usually ignited every year, effectively help to prevent excessive development and spread of this parasite ; 19) *Colasposoma sellatum* Baly, *Rhyparida didyma* Fab. (fam. *Chrysomelidae*) and the leaf eating weevil (*Stenocorynus aridus* Pasc., fam. *Curculionidae*) are rather rare and economically unimportant ; 20) *Aphis sacchari* Zehn., *A. adusta* Zehn. (fam. *Aphididae*), *Tetigonia parthaon* n. sp. Kirk (fam. *Tetigoniidae*), *Perkinsiella saccharicida* Kirk. (fam. *Asiracidae*), *Aleurodes berghi* Sign., snow fly (fam. *Aleuridae*), *Ripersia* sp. (fam. *Coccidae*) and *Pseudococcus* (*calceolariae* Mask ?) (fam. *Coccidae*) cause more or less damage to plants, of which they suck the leaves ; 21) *Lepidiota albohirta* Waterh., *L. frenchi* Blackb., *L. rothei* Blackb., *L. caudata* Blackb., *L. froggatti* Macl. (fam. *Melolonthidae*); *Dasygnathus australis dejeani* Macl., *Xylotrupes australicus* Thomp., *Isodon puncticollis* Macl. (fam. *Dynastidae*); *Cacachroa decorticata* Macl. (fam. *Cetoniidae*); *Anoplognatus boisduvali* Boisd. (fam. *Anoplognatidae*) and *Anomala australasiae* Blackb. (fam. *Rutellidae*) attacks the roots of the cane ; the most formidable among these latter insects is undoubtedly *Lepidiota albohirta*. To control it light traps are used and also arsenical compounds with some success.

1049 - ***Nysius vinitor*, a Hemipterous Pest in Australia.** — Froggat W. W., in *Agricultural Gazette of New South Wales*, Vol. XXVII, 4th Part, pp. 270-272. Sydney, 1916.

The Rutherglen bug (*Nysius vinitor* Berg) which appeared in dense clouds throughout the territory of New South Wales, South Australia and the State of Victoria, has caused much injury there to orchards, seed plots and even garden flowers (1915-1916).

The presence of this insect in a potato and tomato field is immediately revealed by the fall and yellowing of the leaves, and rapid destruction of the fruits. Peaches and apricots are attacked in all stages of growth and spoilt by the numerous holes which *Nysius* opens in the skin in order to draw out the pulp juices.

The following means of control are advised : 1) destroying by fire the grass prairies amid which the insect lays its eggs, and from which the first migrating columns which invade cultivated lands start ; 2) applying an infusion of tobacco and soap ; when the insect is in the early stages of deve-

lopment good results may be obtained ; 3) using kerosene torches against adults ; a bundle of branches fixed to the end of a rod is dipped in kerosene and lit ; by rapidly moving the flame round and among the plants the insects are immediately killed, but care and some skill are required to carry out this operation without burning the leaves or the fruits ; 4) resort may be had to the use of light traps ; good results were obtained with them in several localities, but the method however is too expensive and complicated to become a customary practice on a farm.

1050 - **Unspotted Tentiform Apple Leaf Miner (*Ornix geminatella*), a Microlepidopterous Pest of several Fruit Rosaceae in America.** — HASEMAN L., in *Journal of Agricultural Research*, Vol. VI, No. 8, pp. 289-295, Pl. XXXIII. Washington, D. C., 1916.

*Ornix geminatella* Pack. has been extremely abundant in Missouri of late years, and has attracted the attention of fruit growers throughout the State. The insect lays its eggs on the leaves of several Rosaceae, and the larvae hatched from them bore tunnels in the thickness of the leaves, damaging them to a lesser or greater extent.

Among the hosts of *Ornix* the writer enumerates the following : apple tree, crab-apple (*Malus* sp.), *Crataegus* spp., *Prunus* spp., *Pyrus* spp.

As regards its distribution, *O. geminatella* has been reported in the following localities : New England, New York, Ithaca, (N. Y.), Illinois, Colorado, Kentucky, Michigan, Massachusetts, Connecticut; Ohio, etc.

The natural enemies of this microlepidopteron are recorded so far as: *Sympiesis nigrifemora* Ash., *S. tischerae* Ash., *S. meteori* Girault, *Eulophus lineaticoxa* Girault, *S. dolichogaster* Ash., *S. minutus* Howard and *S. lithocolletidis* Howard.

1051 - **Woolly Pear Aphis (*Eriosoma pyricola* n. sp.), Injurious to the Pear Tree in California.** — BAKER A. C. and DAVIDSON W. M., in *Journal of Agricultural Research*, Vol. VI, No. 10, pp. 351-360, Fig. 1. Washington, D. C., 1916.

The writers describe as a new species, under the name of *Eriosoma pyricola* an aphis hitherto believed to be *E. lanigerum* Hausmann (= *Schizoneura lanigera* Hartig) or " woolly apple-aphis ". This new species attacks the root system of all kinds of pear trees in California, and particularly injures the French wild pear tree so commonly employed as stock, especially for the Bartlett varieties. The Kieffer, and above all the Japanese types, on the other hand, are highly resistant. The wingless form of this aphis usually lives on the fibrous radicles, down to a depth of a yard in the ground, and the colonies are generally more numerous in the vicinity of the trunk, although frequently met with even at 3 or 4 yards' distance. This *Eriosoma* does not confine itself to attacking the young roots, but also, though more rarely, attacks the completely formed roots, and sometimes even the main roots. In this latter case, however, it is localised in the hardened tissues developing in consequence of an abrasion. Colonies of this aphis can even live on the underground part of tender and swollen shoots. It is not like *E. lanigerum*, which produces tuberous excrescences and lesions on the largest roots of the apple tree ; it prefers the rootlets, and destroys them without causing the appearance of any special hypertrophy. Adult trees have little

to fear in the attack of *E. pyricola*, and only in extreme cases can the latter prevent or slightly retard their growth. The case is quite different where it is a question of young plants less than 4 years old. The almost simultaneous loss of a large number of rootlets may completely arrest growth and bring about a premature fall of the leaves, frequently followed by the death of the plant.

Winged forms appear in autumn. In gardens and in all localities where the environmental conditions are favourable to the growth of the winged individuals, the outbreaks in spring and at the beginning of summer are always unimportant, in view of the small number of wingless individuals which hibernate on the roots, while the major part of the colony migrates. From the month of July onwards, however, the aphids increase rapidly, attaining their maximum number in September, at which time the winged forms appear. The departure of the winged swarms, which often migrate even to great distances, also marks a period of rest for the plant, which now having nothing to fear but the few wingless aphids remaining on the roots through winter, puts forth new rootlets and gathers strength to resist fresh attacks.

The winged forms stay on the leaves and trunk of the pear trees, and afterwards generally take up their abode on the foliage and trunk of *Alnus* sp., where they go through their life cycle and produce the sexual generation.

1052 – ***Galerucella cavicollis*, a Coleopterous Pest of Cherry and Peach Trees in the United States** (1). — CUSHMANN R. A. and ISELY DIVIGHT, in *United States Department of Agriculture, Bulletin* No. 352, pp. 1-28, Fig. 1-9, Pl. I-IV. Washington, D. C., 1916.

In the spring of 1915, the cherry and peach plantations extending over a vast area in the north-east of the United States sustained considerable damage from a sudden and formidable outbreak of *Galerucella cavicollis* Le Conte (cherry-leaf beetle). This already known beetle had never previously caused such extensive injury. Among the regions which suffered most are the States of New York and Pennsylvania and the northern part of Western Virginia.

The adults attack the leaves of the cherry and peach and the fruits of the cherry, gnawing them and producing fairly deep injuries. When the attack is very severe, the plants may be almost completely stripped of leaves. The natural host of *Galerucella* is said to be *Prunus pensylvanica* (bird cherry) which spreads with great rapidity along the road sides in the thickets and on the lands formerly occupied by forests destroyed by fire, which form a very favourable environment for the growth and multiplication of the insect. The latter hibernates in the adult form, leaving its shelter in the spring ; it mates and the female oviposits at the foot of the trees amid the dried leaves and other vegetable detritus. The larvae hatch in a fortnight, and when full grown, pupate in a hole which they have made in the soil. The adults emerge in two or three weeks and spread through the plantations where they attack the leaves and fruits. This continues

(1) See *B.* June 1916, No. 718. (*Ed.*)

throughout the good season until the first colds compel them to seek shelter.

Among the natural enemies of *Galerucella* mention must be made of the coleopteron *Lebia ornata* Say, which attacks the adults, tears off the elytra and feeds on the soft tissues. It also kills the pupae and feeds on them, only leaving the pupal skin intact.

For control there are advised : 1) applications of 40 % solutions of nicotine sulphate, in the proportion of one part to 600 of water ; the addition of soap (1 part per 200 of mixture) increases the efficacy ; 2) applications of sweetened lead arsenate, especially for cherry trees, according to the following formula : 1.3 lb. lead arsenate, 0.33 galls of treacle and 11 galls of water.

1053 - **Terrapin Scale (*Eulecanium nigrofasciatum*), Injurious to the Peach Tree in America.** — SIMANTON F. L., in *United States Department of Agriculture, Bureau of Entomology, Bulletin* No. 351, pp. 1-96, Fig. 20. Washington, D. C., 1916.

*Eulecanium nigrofasciatum* Pergande causes more and more serious injury to peach trees in the eastern States and especially in Pennsylvania and Maryland. From here it has spread to the north where it attacks other plants, among which *Acer pseudoplatanus* L. and *A. saccharinum* L. are its favourite hosts. Towards the south-west, it has already reached the Gulf States and has attacked *Phoradendron* spp., on which it thrives well. The range of this *Eulecanium* tends to increase in such measure that it soon will probably be spread in all the regions where the peach, the plum, *Acer* spp. (maple) and *Phoradendron* spp. occur in abundance.

Host plants are : the sycamore maple (*Acer pseudoplatanus* L.) ; silver maple (*A. saccharinum* L.) ; sugar maple or rock maple (*A. saccharum* L.) ; *Amygdalus Persica* L. and its varieties ; spice-bush (*Benzoin aestivale* (L.) Nees) ; *Betula* spp. ; saffron plum (*Boumelia augustifolia* Nutt.) ; *Castanea dentata* (Marsh.) Borkh. ; red-bud (*Cercis canadensis* L.) ; Japan quince (*Chaenomeles japonica* Lindl.) ; *Clematis* sp. ; hawthorn (*Crataegus Oxycantha* L.) ; *Crataegus* spp. ; quince (*Cydonia oblonga* Mill.) ; oleaster (*Elaeagnus angustifolia* L.) ; " wahoo " or " burning bush " (*Evonymus atropurpureus* Jacq.) ; *Fraxinus* sp. ; American holly or white holly (*Ilex opaca* Ait.) ; sweet bay (*Magnolia virginiana* L.) ; wild China tree (*Melia Azedarach* L.) ; *Morus* sp. ; *Nerium Oleander* L. ; *Olea* sp. ; wild cherry (*Padus* sp.) ; mistletoe (*Phoradendron* spp.) ; sycamore or plane-tree (*Platanus occidentalis* L.) ; European plane-tree (*P. orientalis*) ; cottonwood (*Populus deltoides* Marsh.) ; Simon plum or apricot plum (*Prunus Simoni* Carr.) ; *Prunus* spp. ; *Pyrus communis* L. ; *P. Malus* (L.) Britton ; live oak (*Quercus virginiana* Mill.) ; *Ribes* spp. ; *Rosa* spp. ; weeping willow (*Salix babylonica* L.) ; *Salix* spp. ; soapberry (*Sapindus marginatus* Willd. ; *Tilia* spp. ; *Vaccinium* spp. ; *Vitis vinifera* L. ; and *Vitis* spp.

Of the numerous cultivated host plants, the peach tree has suffered most up to now. *Eulecanium* causes two-fold injury : 1) it abstracts the sap, and thus in course of time weakens the leaves and impairs their functions ; 2) it deposits honey-dew on the leaves and fruits, which are rendered use-

less both owing to this fact and to the abundant growth of fungi, which find an excellent medium in this honey-dew.

The natural enemies of *Eulecanium* may be divided into two groups : *a*) the predatory enemies, which prey on the young stages or adult insects ; *b*) parasites.

Among the predatory enemies are : lace-wing fly (*Chrysopa nigricornis* Burm.); *Hemerobius stigmaterus* Fitch. ; *Laetilia coccidivora* Comst. ; *Camptobrochis nebulosus* Uhl, ; and *Hyperaspis binotata* Say.

Among the parasites are *Coccophagus ater* How. ; *C. cognatus* How. ; *C. lecanii* Fitch. ; *c. cinguliventris* Gir. ; *C. longifasciatus* How. ; *C. flavoscutellum* Ashm ; *C. fraternus* How. ; *Aphycus annulipes* Ash. ; *A johnsonii* How. : *A. stomachosus* Gir. ; *Anagyrus nubilipennis* Gir. ; *Eunotus lividis*, Ashm ; *Pachyneuron altiscuta* How. ; *Prospalta aurantii* How. ; *Chiloneurus albicornis* How. ; *Blastothrix sericea* Dalm. and *Comys fusca* How.

As artificial means of control, it is advised to apply : 1) in the spring, before the buds open, the following mixture :

| | |
|---|---|
| Raw linseed oil | 5 gallons. |
| Gasoline | 3 " |
| Soap | 2 pounds |
| Water | 92 gallons |

2) after the trees are in full foliage, and before the *Eulecanium* migrates leafward, apply the following :

| | |
|---|---|
| Flour (in paste) | 10 pounds |
| Stone Lime | 15 " |
| Sulphur | 20 " |
| Water to make | 50 gallons |

1054 - ***Anastrepha serpentina*, a Dipteron Injurious to Several Fruit Plants in Brazil** (1). — DA COSTA LIMA A., in *Boletim do Ministerio de Agricultura, Industria e Commercio*, Year IV, No. 3, pp 99-104. 1 Pl. Rio de Janeiro, 1916.

In Brazil, *Anastrepha serpentina* Wied (" mosca de frutas ") injures the fruit of the following plants : *Mammea americana* L. (" abricoteiro do Parà "), *Lucuma Caimito* A. D. C. (" abieiro "), *Mimusops coriacea* Miq. (" abricoteiro ") and *Sapota achras* Mill. (" sapoteiro ").

The female bores a hole in the pericarp and deposits its eggs therein, as many as twenty at a time ; the larvae, which hatch within 3 or 4 days, feed on the pulp, in which they tunnel, often causing the fall of the fruit.

Means of control : 1) gathering and destroying the damaged fruit ; 2) spraying with sweetened arsenical solutions (for instance : raw sugar, 2.5 lbs. ; lead arsenate 3 oz. ; water, 4 galls.) ; the applications must be made every 15 days ; 3) vessels containing poisoned attractive substances (for instance, sugared water and arsenic salts), which are suspended to the branches of the fruit plants attacked.

1055 - **Gravepine Flea Beetle (*Haltica chalybea*), a Coleopterous Pest of *Vitis rotundifolia* and *V. Munsoniana* (Muscadine grapes) in the United States of America.** — See No. 987 of this *Bulletin*.

(1) See *B.* April 1915, No. 454. (*Ed.*)

## INJURIOUS VERTEBRATES.

1056 - **The Control of Field Voles in Italy.** — SPLENDORE ALFONSO, in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Series 5, Vol. XXV, 2nd Half Year, Part I, pp. 46-49. Rome, July 1916.

In Capitanata (province of Foggia) and the adjoining provinces (1) which have been invaded by field voles, the Italian Government has *inter alia* appointed a Committee instructed to take such measures as may be best adapted to combat this scourge.

Technical experts have been sent to the region over-run, both in order to study the effects on the spot and to undertake control measures by all possible means. Ditches have been excavated and traps used to prevent or at any rate limit the spread of the field voles from the fields to the vineyards. Different poisoned baits have been put down, and different kinds of virus have also been used.

The ditches and traps proved effective, but insufficient to achieve the purpose in view of the extent of the infested parts and the considerable number of the rodents.

Among the poison used, zinc phosphide alone proved efficacious (2).

The different viruses gave negative results undoubtedly owing to loss of their virulence.

It is well known that the viruses which have been recognised as suitable for field vole control are Löffler's bacillus and Danysz's bacillus (3). They may be transmitted to field voles either by subcutaneous injections or through the digestive passages, but the drawback is that the cultures easily lose their virulence. The Ministry of Agriculture therefore instructed the writer to undertake investigations with the object of producing a new virus of sufficient activity for the case in question; the investigations were carried out partly in Capitanata and partly in the Laboratory of Agricultural Entomology of the Royal University of Rome.

In field voles (*Pytymys savii*) captured at Cerignola, the writer observed the constant presence of a micrococcus, both in the circulating blood and in the various internal organs, and the lymphatic glands in different parts of the body. In some of these rodents, for which a microscopic examination of the internal organs had given negative or almost negative results, the germ was found in large quantities in the lymphatic glands of the axillae. The micro-organism is readily stained with aniline dye and Gram's stain. In the tissues, where it occurs both within and without the cells, it often has the coccoform and even diplococcal appearance; in artificial cultures (agar and ordinary bouillon) it retains this appearance for some time; later on, it takes on a more and more bacillary aspect, and occurs likewise in short and thick-

(1) See *B.* August 1916, No. 921. (*Ed.*)

(2) See *B.* January 1914, No. 89.

(3) See *B.* Jan. 1911, No. 362; *B.* June 1911, No. 2016; *B.* Oct. 1912, No. 1488; *B.* Nov. 1912, N. 1567; *B.* July 1913, No. 897; *B.* Jan. 1915, No. 132. (*Ed.*)

set forms sometimes polar staining with aniline dyes. At Cerignola the writer found this micro-organism both in dead and dying voles, and even in some living animals more or less healthy in appearance. Certain it is that the presence of the micrococcus is accompanied by a high mortality. On the other hand, in the field voles captured and examined at Foggia the writer did not find either any infection produced by the above germ or epidemic disease.

The writer advises scattering the dead field voles collected in the principal centre of the infection (region of Contessa near Cerignola) through the other regions over-run by these rodents, but where infection in these latter has not yet taken place.

The writer is continuing his enquiries in order to ascertain : whether the virus can be communicated by means of ectoparasites (fleas and especially lice) ; whether the micro-organism observed by him is more or less analogous to that of Löffler and Danysz ; whether it is utilisable in field vole control and in what way.

ALFREDO RUGGERI, *gerente responsabile*.

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

# INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

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**The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.**

**The Editor's notes are marked (*Ed.*).**

FIRST PART.

# ORIGINAL ARTICLES

## The Selection and Hybridisation of American Vines in Italy

by

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### Historical.

The replanting with resistant vines or reconstitution of the vineyards destroyed by phylloxera, was begun in Italy more than thirty years ago. For this purpose seeds of American and French vines were imported, and from these plants were obtained, of which only the strongest and those which retained intact the characteristics of their species were preserved. At the same time the work of hybridisation between these plants and the native vines was started, but, since it was necessary to submit the plants produced to long trials, they were not introduced at once into general cultivation. However, definite conclusions as regards many of these hybrids produced in Italy and especially in Sicily cannot yet be given, for their cultural value has not yet been tested in a sufficient number of localities or in sufficiently diverse conditions. On the contrary, for other hybrids experimental trials are already numerous and it is possible to state that they possess valuable qualities as regards resistance to phylloxera and to drought, adaptability to different soil conditions, and affinity for the native vines.

At the beginning of the work of reconstitution all the facts of this important problem were not known. The vine-growers were accustomed to see the European vine prosper in almost all soils and the most diverse conditions, and believed that the American vines would do so ; they forgot that the innumerable varieties of the former belonged to one species (*Vitis vinifera*), while the latter group was composed of various species adapted, throughout centuries, to live only in special conditions. As a result fail-

ures in the culture of the American vines were of frequent occurrence; either the vine chosen as stock (graft-bearer) was not adapted to the nature of the soil, or the grafting rarely took successfully, or else the vine showed but little affinity for the native plants chosen as scions. This explains the fact that certain vines, such as York Madeira, which gave rise to much enthusiasm at first, disappeared rapidly from the reconstituted vineyards; that others, such as Clinton and Jacquez, commended as direct bearers of good grapes, have suffered the same fate or have remained only in limited areas, and finally that certain excellent vines, such as Riparia, which is cultivated in all districts, do not always give the results expected from them.

Failures of this kind, however, have been experienced in other countries ravaged by the pest of phylloxera; in France, for example, where in the early years of reconstruction the vines Taylor, Concord, Clinton, York Madeira, Jacquez, etc. were widely planted, though but few examples of these vines are found there today.

France, which had preceded Italy in the work of reconstitution, had in the meantime selected certain American vines and had produced some new hybrids which, tested in the vine-growing regions, had given good results. The Italian vine-growers, discouraged by their failures with plants grown from seed, had recourse to the vines produced in France, and began to import them. These vines were derived partly from the selection of pure species (Riparia Gloire and Grand glabre-Rupestris Martin, Ganzin, and Metalique-Berlandieri Resseguier Nos. 1 & 2) and partly from hybrids. The latter group had been obtained by crossing American vines partly among themselves (Riparia × Rupestris Couderc 3306 and 3309 etc.) and partly with French vines (Aramon × Rupestris Ganzin No. 1 — Mourvedre × Rupestris 1202 — Chasselas × Berlandieri 41 B., etc.).

In addition to these plants destined to serve as stocks, the French vine-growers endeavoured to obtain hybrids which would act as direct-bearers, and many of such hybrids obtained by Conderc, Seibel, Castel, etc., were introduced into Italy. These plants, however, did not generally give the results which were expected from them, and were not widely cultivated.

The Italian Ministry of Agriculture greatly encouraged the distribution of the French stocks, but the work of selection and hybridisation was regarded as superfluous and its cessation was ordered in the institutions under government control. Reconstitution by means of French stocks alone was encouraged; these were distributed everywhere but were not always chosen with sufficient care. As a result the excellent work of Grimaldi, Ruggeri, Paulsen, Longo and others who believed in reconstitution with American-Italian plants was neglected and sometimes interrupted.

In practice this new departure in the work of reconstitution did not always give the results which were expected, and numerous and serious failures occurred especially in districts with a dry climate, so different from those in which the new vines had been developed and selected. These

failures are easily explained by the phenomenon so well described by Prof. ORAZIO COMES, director of the College of Agriculture at Portici : " A plant cultivated in a climate different from that of its native country preserves, and may even increase, its original resistance to injurious conditions if it has been transplanted to a colder climate " ; on the contrary it gradually loses this resistance in proportion to increased warmth in the climate. (1)

It is undoubtedly easier and more expeditious to introduce into a country plants which have already been tested elsewhere, than to select the native plants, but the results are often less satisfactory. D. FREDERICO PAULSEN (2), director of the American Vine Nursery at Palermo, has stated, during the course of a vigorous and impartial enquiry in the vineyards of Sicily, that the American vines with which many vineyards have been replanted are often *less productive* than native vines planted in identical conditions, and that the reconstituted vineyards *do not last as long* as the old vineyards of *Vinifera* planted as a selfbearer. On the contrary in France the new plants produce abundantly ; it is not unusual to obtain 1800, 2200 even 2700 gallons of wine per acre especially in the south with the vine Aramon. It is evident, Dr. Paulsen states, that the lesser production obtained in Italy is contrary to the facts observed in France where reconstitution was first started, and where the serious problems which it entails have been largely studied.

The Italian Ministry of Agriculture was naturally troubled at the decay of the vineyards replanted with stocks imported from France and in 1914 it was decided to revert to the previous methods. The institutions under government control were ordered to undertake experimental work with the object of producing indigenous stocks, which would be more suited to local conditions and would possess more affinity for grafting with the local vines. The directors of the schools of vine-growing and vine-making, of the agricultural colleges, of the American vine nurseries, as well as the technical experts at the head of the anti-phylloxera associations (" Consorzi antifillosserici ") welcomed with enthusiasm this new course, the adoption of which had been previously urged in vain by many of them. The work is now carried on with much activity in the above named institutions, in fact in some of them it had never been interrupted. As the greater part of this new work has only just started, results can only be given by those institutions, or individuals, who had undertaken the work in the earlier period and had never entirely relinquished it. The selection of vines has in some cases been carried on for several years for the experiments with them were still conducted in spite of the regulations to the contrary which were in force for some time. It is possible to state

(1) Prof. O. COMES, La Profilassi, nella patologia vegetale. *Reale Istituto d'incoraggiamento di Napoli*, pp, 19 Naples, Cooperativa tipografica. See also *B.* August 1916, No. 937.

(2) Dr. F. PAULSEN, Risultati della ricostituzione in Sicilia. Ammaestramenti del passato e consigli per l'avvenire. Relazione presentata al Congresso dei viticultori siciliani tenutosi a Noto il 24 agosto 1914. Palermo, Tipografia G. Di Giorgi, 1914.

briefly the chief results obtained by the government institutions, by the anti-phylloxera associations, and also by certain vine-growers, interested in their occupation, who have succeeded at considerable expense and thanks to indefatigable labour in producing vines of considerable value.

In giving the following results it is convenient to group them according to the nature of the institutions in which the work has been carried out, thus — agricultural colleges, government nurseries for American vines, anti-phylloxera associations, private vineyards.

### Work carried out by agricultural colleges and schools.

1) *Alba (Piedmont), School of Vine-growing and Wine-making.* — This school, which is now directed by Prof. F. A. Sannino, took up the work of hybridisation between American vines and those of Piedmont at the time when the late Prof. Domizio Cavazza was at its head.

A hybrid Barbera × Rupestris Cavazza N° 1, of which the female parent occurs in the garden of the castle of Barbaresco, appears to be doing well and promises to give good results in the future; in the experimental vineyard of Vallecrosia it lasted from 1889 to 1907 in which year the vineyard was suppressed. On the estate known as *Bricco*, which belongs to the Cavazza family, it has been cultivated partly as a self-bearer and partly by grafting. It is hoped that it will form a good stock for the region of Piedmont and especially for the vine Barbera.

Among other hybrids obtained by Cavazza, the following may be mentioned;

Barbera × Rupestris; still in the experimental stage.

A hybrid of Berlandieri (from seed) obtained in 1888.

Another special hybrid of Berlandieri.

Solonis × Nebbiolo Cavazza No. 11.

Barbera × Rupestris Cavazza No. 2, of which the plants bearing the numbers 22, 26, 28, are the earliest and most prolific; they have a pale green foliage which recalls that of Gamay Couderc.

Barbera × Rupestris Cavazza No. 3.

Barbera × Rupestris Cavazza No. 4, which is somewhat susceptible to mildew.

Some hybrids Dolcetto × Rupestris bearing the numbers 5, 6, 7, 9.

Dolcetto × Jacquez No. 10, prolific, fairly resistant to mildew and oidium.

2) *Avellino (Campania), School of Vine-growing and Wine-making.* — At this School, under the directorship of Prof. Giulio Paris, Riparis, Rupestris, and Berlandieri plants have been obtained from American seed, but the Riparia plants have been specially selected as more adapted to the deep, light, and moist, volcanic soils of the region of Avellino and of a large portion of Campania. The selected Riparia have large entire leaves; these are glabrous on both surfaces, shining and slightly crinkled; they recall the types Gloires and Grand glabre. Some types obtained at Avellino are somewhat superior to the French types as regards vigour and

beauty of foliage. Their resistance has been the subject of experimental tests at Macomer in Sardinia. In 1890 the best plants of selected Riparia were crossed with Rupestris derived from seed; crosses were also begun between Rupestris and foreign vines (Malbec, Sirah, Cabernet, Pinot, Muscat violet etc.). In 1893 Italian-American hybrids of Sangiove, Malvoisie de Toscane, Aglianico, Sciascinoso, Aleatico, with Rupestris were obtained.

Finally in 1903 and 1904 vines selected in France were brought from the Tremiti Islands and hybridisation with American vines was given up. On the other hand crosses of various European vines among themselves were started with the object of obtaining better grapes, and among other hybrids the following were produced :

| | | |
|---|---|---|
| Trebbiano | × | Riesling du Rhin |
| Trebbiano | × | Pinot blanc |
| Trebbiano | × | Traminer blanc |
| Malvoisie | × | Sauvignon |
| Malvoisie | × | Riesling |
| Aglianico | × | Merlot |
| Aglianico | × | Cabernet |
| Aglianico | × | Pinot |

3) *Cagliari* (*Sardinia*) *and Catania* (*Sicily*), *Schools of Vine-growing and Wine-making. Florence* (*Tuscany*) *School of Horticulture and Fruit-growing.* — From seeds imported from America some good types have been produced, which have given satisfactory results in those districts where they were obtained.

4) *Conegliano* (*Venezia*), *School of Vine-growing and Wine-making.* — From seedlings of Riparia, a Riparia tomentosa was selected which was extensively cultivated in the district of Conegliano; it gave such good results that some vineyards grafted on this plant are still found in full production after thirty years.

This type as well as other excellent types obtained from seed were given up when vine plants selected in France were imported. At the same time selections from cuttings of American and European vines were tried, and the method proposed by RAVAZ was employed as the basis of selection (*i. e.* the starch content of the cutting is determined by the iodine reaction) but these experiments were interrupted by changes in the staff of the school.

Twenty years ago some hybrids of Cinerea × Pagadebito were obtained ; these were not devoid of interest but the experiment was not followed up.

DALMASSO, professor of vine-growing and wine-making, has at the present time extended the observations and researches on the adaption and affinity of the principal American stocks, and has taken up the work of hybridisation and selection conducting the latter according to the method proposed by RAVAZ.

5) *Grumello del Monte* (*Lombardy*), *School of Practical Agriculture.* — Some good types have been obtained from vines grown from seed, and

among these a Riparia glabre with large hardy leaves similar to those of Grand glabre may be noted; it is a suitable plant for the reconstitution of the vine-yards in some districts of the province of Bergamo.

### Work carried out by the government nurseries for American vines.

1) *Nursery at Acqui* (*Piedmont*). -- This nursery was only established in 1910 and has not yet produced plants which have been sufficiently tested. Three numbers of Berlandieri × Riparia obtained at Asti from seed of Berlandieri Resseguier No. 1 from France, have been selected. Some Italian-American hybrids obtained in the Asti Nursery have been planted permanently and kept under observation; these were as follows:

| | | |
|---|---|---|
| Lambrusca | × | Ruspestris du Lot |
| Lambrusca | × | Berlandieri |
| Grignolino | × | Berlandieri |
| Lambrusca | × | Berlandieri-Riparia 157-11 |
| Freisa | × | Rupestris du Lot |
| Barbera | × | Rupestris metallica |
| Cortese | × | Rupestris du Lot |
| Cortese | × | Rupestris-Berlandieri 301 B, |

These hybrids have up to the present remained exempt from phylloxera.

2) *Nursery at Asti* (*Piedmont*). — This nursery is no longer under government control and has been annexed by the anti-phylloxera association of the district. Selections of Riparia and Rupestris and of some other species have been made but the results are of little value.

Hybridisations were also carried out but they have not been continued. (See the above paragraph).

3) *Nurseries at Cagliari and at Macomer* (*Sardinia*). — For fifteen years these nurseries have cultivated some numbers of Riparia, of Rupestris, and of Berlandieri obtained from seed in the following institutions: School of Vine-growing and Wine-making of Avellino — School of Horticulture and Fruit-growing at Florence — Nurseries at Velletri and at Barletta; but these trials conducted in a single locality and in restricted areas are not yet conclusive. It is possible to state, however, that the plants are growing well and promise to be valuable.

4) *Nursery of Noto* (*Sicily*). — The director, Dr. C. Montoneri, has obtained two varieties of Rupestris: — Rupestris Noto No. 2, and Rupestris Noto No. 23, which are resistant to phylloxera, to drought and to large amounts of lime in the soil; they do well when used as cuttings and as grafts and have a marked affinity for the native vines, to which they give remarkable fertility. Prof. Di Mattei, in his report to the Congress of Noto in August 1914, advised the use of these two Rupestris in the place of Rupestris du Lot which is very liable to " bramble-leaf " (roncet), and predisposes the vine to abortion of the flowers.

Rupestris Montoneri No. 1 and No. 2, which are also cultivated, are both extremely promising.

Numerous experiments in hybridisation have been made but definite results with regard to the hybrids obtained cannot yet be given.

5) *Nursery of Palermo* (*Sicily*). — The Director, Dr. FEDERICO PAULSEN, has obtained several thousands of hybrids and has carefully selected them after several years of cultivation. As Dr. PAULSEN himself observes, it is difficult to find a stock which is able to offer identical advantages in the various conditions of cultivation, and these hybrids have therefore been tested in the experimented vineyards of the nursery and in those of private vine-growers. In some cases plots were planted with free stocks grafted on the spot, and similar plots with stocks grafted elswhere, and then permanently planted.

Of the hybrids bearing the numbers 1 to 1450, those which have given the best results in the first trial as regards resistance to phylloxera, luxuriance of vegetation and affinity for the local vines Inzolia and Pericone are:

| | | |
|---|---|---|
| Mollacchina | × | Rupestris 401 |
| Perricone | × | Rupestris 417 |
| Berlandieri Catania | × | Catarratto 737 |
| Berlandieri Catania | × | Riparia 810 |
| Catarratto | × | Rupestris Ganzin 877 |
| Mollacchia | × | Rupestris 403 |
| Berlandieri 2 | × | Rupestris Monticola 782 |
| Ciminnita | × | 1202, bearing the number 1056 |
| Catarratto | × | Rupestris du Lot 1072 |
| Catarratto | × | Rupestris du Lot 1074 |
| Berlandieri | × | Rupestris du Lot 1163 |
| Jacquez | × | 1202, bearing the number 1256 |
| Berlandieri 1 | × | Aramon-Rupestris 1330 |
| Berlandieri 1 | × | Rupestris Martin 1341 |

It was found as the result of numerous observations made under various conditions that a different stock was required for each kind of soil and often for each kind of scion. Dr. PAULSEN states in this connection that the difference in adaptive qualities between the various stocks become more evident as the conditions of reconstitution become more difficult. In the southern districts, where the two main factors which hinder replanting with American vines are drought and the intensity of the phylloxera pest, the choice of stocks should be made with special care, and should be suited to the frequent changes in the nature of the soil and in the climatic conditions.

At the present time among the thousands of hybrids produced and extensively tested by Dr. PAULSEN the following numbers may be recommended:

P. 1043 (Berliandieri × Aramon Rupestrs) and P. 1341 (Berlandieri × Rupestris Martin) are very suitable for light, sandy calcareous soils with a tufaceous and strongly calcareous sub-soil. In the experimental vineyard of Casa Bianca (Marsala) Number 1043, though it grows but moderately as a free stock, bears vigorous scions which make a throughly good growth even in the driest years. Number 1341 has always retained its

fine vegetation and the scions have always given a good and constant production.

P. 779 (Catarratto × Berlandieri) is very suitable for light sandy or calcareous soils and continues to do well in the experimental vineyard of Casa Bianca. It has given the most satisfactory results on deep loam soils which are not too dry (experimental vineyard of Spadafora) ; in such conditions it grows freely and bears productive scions.

P. 1548 (Berlandieri × Aramon Rupestris) has a normal development and a normal and constant productivity on deep loam soils which are very compact (experimental vineyard of Roccazzo). In the experimental vineyard of Mazara on a light, calcareous soil with a compact and strongly calcareous sub-soil this number shows a fine vegetative growth after three years both as a free stock and as a graft.

1742 (Berlandieri × Rupestris du Lot) and P. 1902 (Catarratto × Rupestris du Lot) are well adapted to deep, compact, loams, like those of Roccazzo, where they have done well for several years.

Riparia × Rupestris N° 2 A, selection P, has been derived from the selection of plants obtained from seeds of Rupestris. It is easily propagated by cuttings, develops rapidly and gives a luxuriant vegetative growth.

It grafts successfully and produces fruitful plants. It is specially suitable to medium loams which are not very compact but fairly deep and moist.

6) *Nursery at Palmi and at Nicastro* (*Calabria*). — The reproduction of some Riparia plants from seed and the formation of Calabrian-American hybrids has been started, but it is not yet possible to give the results of the work.

7) *Experimental vineyard of Spadafora* (*Sicily*). — At Syracuse the late Prof. Antonio Ruggeri, with the assistance of Cavaliere Beniamino Antoci, began to select American vines grown from seed, especially plants of Berlandieri : he also began to cross Berlandieri, and Rupestris du Lot, with some of the most popular local vines. When transferred to Milazzo, he took with him young plants produced at Syracuse and continued and extended the work of hybridisation. As the nature of the soil of the nursery at Milazzo did not allow him to undertake conclusive trials, he established an experimental vineyard at Spadafora. Here he brought to a successful termination some experimental trials worthy of mention, both with vines due to his own efforts and with those produced by Grimaldi and Paulsen as well as with some types of Berlandieri selected at Barletta. Trials were also carried out in private vineyards on various types of soil infested with phylloxera ; the soil was in some cases clayey and compact, in others of medium consistancy and fertile, or again light and poor. It is, in consequence, possible to bring together observations which indicate that certain vines tested over long periods, are suitable for introduction into general cultivation. The introduction of such vines is of special importance, as the decay of the vineyards reconstituted with stocks from beyond the Alps has shown the necessity of reconstitution

with indigenous vines which are more suitable to the soil and climatic conditions of Italy.

Out of Sicily the hybrids due to RUGGERI have been grown with excellent results in Apulia, in Calabria and in other countries than Italy. At the International Congress of Agriculture at Madrid (1911), M GARCIA DE LOS SALMONES recommended from his personal experience twelve numbers of this hybrid for cultivation on dry calcareous soils. A collection of these hybrids has been sent to Algeria at the request of Prof. MARÈS who had ascertained their success in Sicily.

Among the numerous hybrids produced by RUGGERI the following may be noted :

130 (Berlandieri × Rupestris). — This hybrid is adapted to various types of soils, including soils light in colour and thoroughly calcareous in character on which it has given good results.

42 (Berlandieri × Rupestris du Lot). This hybrid does well over a fairly extensive area. It grows freely on moist marls even on those rich in lime (50 to 60 per cent Ca $C_0$3). It is not always as resistant as 140 and cannot be recommended for clay soils on which it develops but moderately.

199, 225, 267 (Berlandieri × Riparia). These vigorous hybrids maintain the productivity of the scion at a high level and are suitable for cultivation over a fairly extensive area, especially 199 and 225. The last number, 267, prefers the same soils as Riparia and on them it surpasses the pure species, but it is also successful on soils of poorer quality. Although vigorous 199 and 225 are not equal to 267 on soils which are suitable for the latter but they are more resistant to drought and will tolerate larger amounts of lime in the soil.

19 (Albanello × Berlandieri). The resistance to phylloxera of this hybrid is very great : after 10 years of cultivation its roots are in as good condition as those of the most resistant pure species. It has a marked affinity for the native vines and as it is tolerant of drought and of a large amount of lime, it does well over a fairly extensive area. The production of plants grafted on this stock is regular and constant.

8) *Nursery of the Tremiti Islands* (*Adriatic*) (1). — No selections of plants grown from seed have been made but hybrids have been produced between American vines (Rupestris and Berlandieri) and numerous Italian vines (Trebbiano, Sangiovese, Malvoisie, Moscatello, etc). Some of these hybrids have already been tested in different provinces of Italy especially in Apulia. The tests, however, have not yet been carried out for a sufficiently long period to justify statements on these hybrids. Hybrids between various American vines have also been obtained but they are not altogether satisfactory, especially in regard to their adaptive qualities.

9) *Nursery at Velletri* (*Rome*). — The Director Professor ANGELO LONGO has selected 40 numbers of Riparia and 11 of Rupestris grown from seed. These vines have been distributed in various districts espe-

(1) See *B.* 1914, No. 246.

cially in Tuscany, in Apulia, in Sicily and in Sardinia. In many cases the results have been satisfactory, both as regards resistance to phylloxera and drought, and as regards vigour of growth and productivity. This, however, has not always been the case. For example in Tuscany, in the valley of the Arno and on the plains of Prato and Pistoia, where quaternary soils occur, these vines have given excellent results : on the other hand they have given less satisfactory ones in the following districts : in Chianti and in the valley of the Sieve where gravels intercalated in the calcareous " alberesi " of the Eocene are abundant : on the hillsides of the Upper Valdarno and of the valley of Greve, where marly calcareous soils and cretaceous gravels occur : in the valleys of Elsa and Pisa where clayey marls alternate with the conglomerates, gravels and sands of the Oligocene. In Apulia and Sicily and in Sardinia the results have in the same way been excellent in some regions and poor in others. At Marsala, for example, on soils with as much as 85 % per cent of lime, the director of the local anti-phylloxera association considers that the results have been satisfactory.

## Work of the Anti-Phylloxera Associations.

These associations were instituted with the object of protecting vine-growing against the attacks of phylloxera. They were first formed in Apulia and later in all Italian districts where such action was necessary, and aim, by the introduction of America vines, to reconstitute the vineyards destroyed by this terrible pest. The associations, directed by technical experts, have also undertaken experimental work in selection and hybridisation, with the object of obtaining stocks suitable to the districts in which they are to be cultivated. The initial work of these experiments was undertaken by the late Prof. Neobaldo Danesi, general inspector of agricultural industries, assisted by the technical representatives of the anti-phylloxera societies and especially Dr. Armando Mignone as well as by the director of the Experimental Nursery of the Tremiti Islands.

Numerous crossings were made between the local vines, of which the best as regards hardiness and longevity were chosen, and such American vines as lent themselves to the process : (Rupestris Martin and Rupestris Metallica Berlandieri and its hybrids Riparia and Rupestris). Attempts were also made to cross certain American vines among themselves, such as : Rupestris Ganzin, Rupestris Martin, Rupestris Gaillard, Rupestris du Lot, Cordifolia typique and Cordifolia Davin, Aestivalis, Berlandieri, all calcicole (lime-loving) vines. Definite results have not yet been obtained but it can already be foreseen that the societies, in following up the work in which they are engaged, will be able shortly to provide for each district stocks and possibly direct bearers thoroughly acclimatised and very resistant to phylloxera. It is expected that these plants will show adaptive qualities, possess a strong affnity for the local vines, and will be capable of giving better results in practical cultivation than the vines commonly employed to-day.

To test the hybiids obtained by Danesi and by the staff of the anti-

phylloxera associations, *two fields for experiments on the resistance of American vines to phylloxera were instituted in Apulia.* These fields are in the district of Cassano Murge and of San Michele which in Apulia were among the first to be attacked by the destructive insect. Hybrids obtained by Cavaliere BENIAMINO ANTOCI in the Tremiti Islands, are also studied in these experimental fields.

In addition to resistance to phylloxera, the composition of the grapes of the direct bearers is being studied : this task was entrusted by DANESI to the School of Olive-growing and Oil-making at Bari.

The experiments made at Marsala by Cavaliere GIUSEPPE VAIARELLO, director of the Anti-phylloxera Society of that locality, are also of sufficient interest to be mentioned. In the nurseries of the association the Sicilian-American hybrids of PAULSEN and GRIMALDI and RUGGERI have been tested. The numbers 88, 110 and 317 of GRIMALDI, the numbers 110, 128, 140 and 298 of RUGGERI, and the numbers 779, 1120, 1381, 1548, 1742 and 2A of PAULSEN are specially worthy of consideration. A hybrid which is also expected to do well is Calabrese × Aramon-Rupestris 953, a direct bearer obtained by GRIMALDI.

M. VAIARELLO has also undertaken work on hybridisation, but it would be premature to pronounce judgment on the results obtained.

### WORK CARRIED OUT BY PRIVATE VINE-GROWERS.

Some private nurserymen have selected American vines grown from seed, and some of the vines placed by them on the market have given fairly good results in the districts in which they were obtained. However as regards continued and serious work based on scientific principles, only that of the late Dr. CLEMENTE GRIMALDI of Modica can be considered, and to him are due some hybrids which have been successfully introduced into general cultivation. From the beginning of his short career this distinguished worker was actively and usefully employed, thanks to his technical skill, in the production of hybrids suitable for warm districts. Important observations on American vines in general, which he was able to make during the course of his researches, are still turned to advantage by a certain number of Italian and other growers of American vines.

Although the work of Grimaldi was unfortunately interrupted by his early death, the vine growers have been able to profit by his labours to some extent, thanks to certain hybrids of special interest among which the following may be mentioned.

G. 1257 (Berlandieri × Regano). This hybrid is suitable for strongly calcarious soils. It has given good results at Mazzara del Vallo and at Casa Bianca (Marsala) where it has developed remarkably well in spite of the nature of the soil ; calcareous, somewhat poor, and dry.

G. 444 and 446 (Berlandieri × Rupestris). Up to the present these hybrids have made good growth on calcareous soils.

G. 110 and 88 (Calabrese × Rupestris Ganzin) and 317 (Frappato × Rupestris Ganzin). These hybrids are adaptable within wide limits but

they give the best results on strong and light loams. They show well marked affinity for the Marsala vines but are liable to " bramble-leaf " (roncet) by which they have been attacked in several experimental vineyards in Sicily.

G. 953 (Calabrese × Aramon Rupestris). This hybrid is a direct-bearer and has given at Marsala on moist calcareous soils a good wine with the proportions 16.2 per cent alcohol and 7 per cent of acidity (VAIARELLO).

## CONCLUSIONS.

From this brief account the following conclusions can be drawn :

1) The new resistant vines which are necessary for the reconstitution of vineyards destroyed by phylloxera can be obtained (and have already been partly obtained) by the selection of American vines grown from seed, and by the artificial hybridisation (followed by selection) of various American vines partly among themselves and partly with European vines. It was a mistaken policy to interrupt the work which had been started on these lines, and to resort to the use of hybrids and selected plants imported from France. Indeed it is due to the clear-sightedness of some workers on American vines (RUGGERI, PAULSEN, GRIMALDI, LONGO) that good plants produced and selected in Italy can be put into cultivation today.

2) Experience acquired during a number of years has shown clearly that vines obtained and selected in France will not always live under conditions different from those of the country of their origin, as in Sicily, Sardinia, Calabria, and Apulia. The introduction of these French vines into Italy was in many cases unsuccessful and consequently the workers on American vines turned their attention once more to the production and the study of indigenous resistant vines. It was a judicious action on the part of the Ministry of Agriculture in 1914 to direct that the institutions under Government control should resume the work interrupted some years previously.

3) The work of PAULSEN, GRIMALDI and RUGGERI, can be put to profitable account to-day, for the hybrids due to them can, especially in warm districts, replace the vines produced and selected in France. In other districts it is unnecessary to give up French vines entirely, but the Riparia and Rupestris selected by LONGO at Velletri, besides the hybrids of PAULSEN can, with advantage, be introduced into general cultivation.

SECOND PART.

# ABSTRACTS

## AGRICULTURAL INTELLIGENCE

### GENERAL INFORMATION.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

1057 – **Agriculture in Brittany.** — I. PIC, G. Monographie d'une exploitation modèle en Ille et-Vilaine. *La Vie Agricole et Rurale*, Year 6, No 27 (special number on Brittany), pp. 1-4. Paris, July 1, 1916. — II. PARISOT, F. Mise en valeur des dunes. *Id.*, pp. 5-7. — III. MIÈGE, E. La culture de l'ajonc *Id.*, pp. 13-16.—IV. MÉNARD, A. Culture de la pomme de terre de primeur dans les Cotes du Nord. *Id.*, pp. 18-20.—V. VINCENT, V. Cultures maraichères et élevage du cheval combinés dans le pays de Léon *Id.*, pp. 20-22.

I. Small holdings of from 35 to 50 acres are the rule in the department of Ille-et-Vilaine, and farms of over 100 acres are rare. Much of the land is owned by peasant proprietors. The farm selected for description as being typical of the district is about 35 acres in extent, on gently undulating ground, and the soil is a strong loam on a clay subsoil. Many improvements have been carried out: the land has been drained; roads have been made and apple trees planted on either side of them; hedges have been removed, so that the farm now consists of 4 or 5 arable fields of 5 to 7 acres each, 5 acres of grass and 2 ½ acres of orchard. No fixed rotation is adopted, but as far as possible the annual acreage of crops and catch crops is distributed as follows:

| | | | | | |
|---|---|---|---|---|---|
| 7 ½ | acres | winter wheat | 4 | acres | green rye |
| 2 ½ | » | winter oats | 4 | » | trifolium |
| 2 ½ | » | spring » | 1 1/4 | » | vetches |
| 2 ½ | » | barley | 1 1/4 | » | maize |
| 2 ½ | » | buckwheat | 2 ½ | » | mangels |
| 5 | » | red clover | 1 1/4 | » | carrots |
| 2 ½ | » | rape | 1 1/4 | » | cabbages |
| | | | 1 1/4 | » | potatoes |

Besides this, all banks are planted with gorse which yields valuable fodder for horses and cattle in December and January. Thus the 30

acres of arable land not only produce about 30 acres of fodder and grain crops consumed on the farm but also an additional 10 acres of corn crops which are sold away. Average yields for the last 10 years have been :

| | | |
|---|---|---|
| wheat | 5 | qrs. per acre |
| oats | 7 | » » » |
| buckwheat | 5 | » » » |
| mangels | 28 | tons per acre |
| potatoes | 9 ½ | » » » |

The dead stock consists of 2 ploughs, 1 set of harrows, 2 cultivators, 2 horse hoes, 1 small horse drill, 1 mower with corn cutting attachment, 1 swath turner, 1 horse rake. The live stock consists of : (1) a dairy herd of 10 to 12 milking cows (also 3 or 4 heifers, 3 or 4 yearlings and 2 bulls) yielding from 22 ½ cwts. to 28 ½ cwts. of butter per annum and a gross profit of £120 to £165, besides 7 or 8 calves sold fat to the butcher for £20 to £24 ; (2) one old horse and 2 mares from which one foal is bred annually and sold ; (3) about 50 hens and pullets of the de Janzé breed ; and (4) a number of pigs.

The labour is provided by the farmer and his family, a maidservant and a man living in the house, and during the busiest seasons of the year additional men are occasionally hired by the day.

The returns of this type of holding are excellent in the majority of cases and where the farmers, who are generally industrious and fairly enlightened, have also been good business men and skilful cultivators, actual fortunes have been made out of the land.

II. The sand dunes extend over many thousands of acres along the northern and southern coast of Brittany. They are covered by a meagre vegetation consisting chiefly of couch grass, sand sedges, small fescues, sweet vernal, cock's foot and timothy, with occasional clumps of furze, *Ephedra*, asparagus, various medicks, bracken, wild beet, and here and there a pine wood. The dunes are usually either State owned or the property of the communes. In certain parts they have been successfully reclaimed as for instance at Rothéneuf near St. Malo where early vegetables are now grown at a profit, at Roscoff, at Saint-Paul-de-Léon and at Plouhinec near Lorient which is celebrated for its early carrots.

The work of reclamation should always start with ploughing to a depth which varies with the flora. Liming and chalking are useless at the initial stage, but farm yard manure or seaweed must be applied with dressings of superphosphate and potash salts. Levelling should be carried out as far as possible. The most important question is that of protection against wind. In points of extreme exposure *Atriplex*, tamarisk, sea-buckthorn or gorse should be used as wind screens, while white poplar, *Cytisus*, elm and the maritime fir may also be employed with profit. With regard to wind resistant crops the best results have been obtained with rye and cabbages. Once the land is under cultivation, early potatoes, green rye, crimson clover and winter barley may be grown as well as asparagus and lucerne. After the early potatoes, green rye, etc... cabbages, mangels,

carrots and salads or carrots and swedes, turnips, mustard should be taken, as the land will produce two good crops per annum if generously manured.

Its vicinity to the sea-shore makes this possible as the necessary seaweed can thus be obtained at low cost.

III. Gorse is a characteristic wild plant of all granitic or schist soils. About 15 species are known including *Ulex europaeus, U. Gallii, U. Richteri, U. nanus, U. parviflorus,* and the two chief cultivated varieties are the Dinan and the Foxtail which is almost spineless. Gorse not only yields valuable fodder, but affords shelter and may also be used as litter or for green manuring. It has also been suggested as raw material for paper-making. As fodder it may be fed to all kinds of stock and cattle do particularly well on it either when fattening or producing milk.

For its growth a good tilth is required and the land must be clean. Seed may then be broadcasted at the rate of 18 lbs. per acre or drilled at the rate of 9 lbs. per acre as is customary in England. Average yields run from 10 to 12 tons of green stuff per acre which would be equivalent in feeding value to 4 to 5 tons of good hay. Exceptional yields are said to reach 20 to 24 tons per acre. Seed may also be harvested and amounts to 80 to 120 lbs. per acre of the common varieties (worth 10d. per lb.) or 40 to 50 lbs. of Foxtail (worth about 1*s* 3*d* per lb.).

Gorse leaves considerable residues of nitrogen in the soil and its deep roots break up the subsoil to a great depth. Plantations are easily broken up even after being kept down from 6 to 8 years which is the usual duration of their life ; some however are kept down as long as 15 to 20 years.

IV. The cultivation of early potatoes occupies an entire tract of coast land known as "the golden belt of Brittany" where the climate is specially favourable. The most popular varieties are Royal Earlies (frost resistant), Mayette, Sutton, Giant Fluke, Fin de Siècle. Sets are carefully selected and sprouted in boxes or on floors during the autumn. Planting out begins at the end of January and the sets are placed very close together (10 in. × 14 in.), so that about 18 cwts. of seed potatoes are required per acre. Yields are high, the total crop varying from 4 to 6 tons per acre and being worth anything from 3*s* 6*d* to 12*s* per cwt. In an average year the gross profits run from £24 to £32 per acre, but the crop is an expensive one to grow and would hardly pay if it were not for the fact that the potatoes can be followed by mangels, swedes, cabbages or cauliflowers and then by two successive corn crops without any further manuring.

V. The Léon district is not a purely market gardening district except in the Roscoff commune. Elsewhere the market gardening is run together with a horse breeding industry and fodder crops have to be provided for the live stock. Though modified for the special requirements of these farms, the principles of market gardening still obtain and the crops are rarely grown pure. For instance parsnips are interplanted with cauliflowers or artichokes, onions with parsnips, artichokes or cauliflowers, and cauliflowers harvested in February would be followed by spring wheat in

which lucerne would be sown, or trifolium might be taken after the wheat. A typical rotation is given below

1st year : spring wheat and turnips as a catch crop.

2nd year : parsnips with cauliflowers or artichokes.

3rd year : wheat or onions and trifolium.

4th year : cauliflowers.

The chemical requirements of such a rotation are considerable and even assuming that very heavy dressings of seaweed and farm yard manure are available, these should be supplemented by applications of fertilizers

AGRICULTURAL INSTITUTIONS

1058 – **Blind Soldiers on the Land.** — BARONNE THÉNARD, A. (Note from the Valentin, Haüy Association) in *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. II, No. 21, pp. 595-602. Paris, 1916.

Ever since the beginning of the war the Valentin Haüy Association has undertaken the task of helping blind soldiers to earn their own livelihood and whenever it has been possible they have put such soldiers back to their old pre-war trades and occupations. On this principle large numbers of blind men should have been brought back to the land. The Association was already in touch with several men who were successful farmers, poultrymen or bee-keepers in spite of having lost their sight, as for example the owner of a vineyard in Franche-Comté who though he became blind at the age of forty kept on working for many years. Another had been taught a trade specially adapted to the blind (straw and cane work), but preferred an agricultural occupation and rapidly became a skilful labourer. The latter man was an immense help to the Association, for his case could be quoted to the blind soldiers and it could be pointed out to them that they had the advantage of being already familiar with farm operations. He was even charged in July 1915 to go round to the homes of blind soldiers and to show them by his practical example what could be accomplished without sight, to encourage them to be self-reliant, and to induce them to try to pick up the threads of their old life.

The results of this policy have been excellent : one man has gone back to an employer for whom he had previously been working for nine years, and has regained much of his old skill ; another man, besides going back to his original work, has taken charge of 50 beehives to which he attends mostly at night ; a third man who is not only blind but also suffers from slight deafness and a certain weakness in the right arm has taken up the management of a farm again and works himself in the garden and at pruning vines. All show remarkable pluck ; but even the most able man when deprived of his sight is largely at the mercy of his surroundings and could accomplish little without the help and sympathy which are most surely found amongst his own people.

The Valentin Haüy Association is establishing a small poultry farm for blind soldiers, as experiment have recently shown in England that chicken rearing and fattening is work particularly well adapted to the blind.

## CROPS AND CULTIVATION.



1059 – **Measurement of the Surface Forces in Soils.** — SHULL, CHARLES ALBERT, in *The Botanical Gazette*, Vol. LXII, No. 1, pp. 1-31, 8 tables, 5 figs. Chicago, July 1916.

A contribution to our knowledge of the mechanics of soil moisture and the relations of this latter to plant growth. The main purpose of the work was to find some means of measuring the force with which particles of soils of varying fineness retain moisture at different degrees of dryness and to obtain some more definite knowledge concerning the amount of "back pull" occurring in soils when the total moisture content is so low as to be unavailable to growing plants. A number of experiments were carried out on the relation of seeds to soil moisture, an aspect of the question which hitherto has not received the attention it deserves.

The *seeds* of *Xanthium* were chosen for the experiments owing to the rapid re-establishment of moisture equilibrium relations after disturbance. They were derived from 119 plants derived in their turn from the seed of a single plant of *X. pennsylvanicum*; individual variations should therefore be reduced to a minimum.

The *soils* used in the major portion of the work were 1) *the subsoil of the Oswego silt* loam — a heavy clay — and, as a contrast to this, 2) *a fine quartz sand* manufactured from quartz rock and, finally, 3) *various other soil types*, details of which appear in table IV. The average composition of No. 1 as determined by mechanical analysis was as follows:

| Sand | | | | Silt | Clay |
|---|---|---|---|---|---|
| Coarse | Medium | Fine | Very Fine | | |
| 0.4 % | 0.5 % | 4.4 % | 3.2 % | 61.3 % | 30.4 % |

The moisture equivalent was 35.2 per cent and the wilting coefficient 19.1 per cent.

No. 2 was a very pure quartz sand, the average diameter of the particles being very close to 0.10 mm. The moisture equivalent was 2.41 per cent and the wilting coefficient 1.3 per cent.

*Methods.* — While the internal forces of *Xanthium* seeds have been approximated by osmotic means, many seeds lack semi-permeable coats. For such seeds a vapour pressure method has been used which gives results which are in a way comparable to the osmotic measurements. It consists essentially in measuring the vapour pressure equilibrium of the air-dry seeds over sulphuric acid of varying strength and calculating the internal pressure of the seed from the vapour pressure of the solution over which it was found

TABLE I. — *Moisture intake of Xanthium seeds in osmotic solutions; temperature 23.5° C; intake in percentage of air-dry weight.*

| Solutions volume molecular | 1 hour | 4 hours | 7 hours | 10 hours | 24 hours | 48 hours | Osmotic pressure in atmospheres |
|---|---|---|---|---|---|---|---|
| H 2 O . . . . . | 16.39 | 44.38 | 48.78 | 50.38 | 51.18 | 51.58 | 0.0 |
| 0.1 M — Na Cl . . . . . | 16.79 | 39.43 | 45.87 | 46.48 | 46.39 | 46.33 | 3.8 |
| 0.2 M — Na Cl . . . . . | 17.12 | 38.67 | 45.00 | 45.57 | 45.93 | 45.52 | 7.6 |
| 0.3 M — Na Cl . . . . . | 16.07 | 34.05 | 40.75 | 41.95 | 42.24 | 42.05 | 11.4 |
| 0.4 M — Na Cl . . . . . | 14.36 | 31.21 | 38.08 | 39.97 | 40.33 | 40.27 | 15.2 |
| 0.5 M — Na Cl . . . . . | 13.96 | 30.26 | 35.87 | 38.08 | 38.70 | 38.98 | 19.0 |
| 0.6 M — Na Cl . . . . .— | 13.80 | 25.57 | 32.41 | 33.57 | 34.77 | 35.18 | 22.8 |
| 0.7 M — Na Cl . . . . . | 13.32 | 26.29 | 30.99 | 31.73 | 32.79 | 32.85 | 26.6 |
| 0.8 M — Na Cl . . . . . | 13.13 | 25.22 | 29.21 | 29.95 | 31.12 | 31.12 | 30.4 |
| 0.9 M — Na Cl . . . . . | 12.58 | 24.34 | 27.64 | 28.95 | 29.14 | 29.79 | 34.2 |
| 1.0 M — Na Cl . . . . . | 11.90 | 22.92 | 25.42 | 26.48 | 26.21 | 26.73 | 38.0 |
| 2.0 M — Na Cl . . . . . | 8.19 | 14.55 | 18.25 | 18.43 | 18.60 | 1855 | 72.0 |
| 4.0 M — Na Cl . . . . . | 4.81 | 8.37 | 9.84 | 10.08 | 11.00 | 11.76 | 130.0 |
| Sat. — Na Cl . . . . . | 3.42 | 4.94 | 5.24 | 5.84 | 6.21 | 6.35 | 375.0 |
| Sat. — Na Cl . . . . . | — 0.67 | — 0.77 | — 0.58 | — 0.58 | — 0.58 | — 0.29 | 965.0 |

to be in equilibrium. Though by no means exact the calculations are near enough to the osmotic determinations to be of great interest.

The earliest soil measurements were made with No. 2) sand. Seeds of known weight were packed firmly in sand of known water content in paraffined wire baskets, and allowed to come to equilibrium. The tests were confined finally to the region of soil moisture from air-dry to the wilting coefficient, because with a higher moisture content the seeds always became saturated with water. In the case of this sand it was not until the water content was reduced to about 1 per cent that a noticeable " back pull " was developed by the soil.

This method is obviously open to the criticism that friction retards the movement of water in dry soils, and that the seeds therefore do not reach actual equilibrium with the total soil mass, but only with the soil lying near them. In order to meet this difficulty, a rotation method (bottles arranged on rotating wheels driven by a motor) was adopted which brings the seeds constantly into contact with fresh soil particles.

TABLE II. — *Relation of Soil Moisture to Intake by Seeds.*

| Soil moisture in percentage of absolute weight | Intake by seeds in percentage of air-dry weight | Osmotic pressure equal to surface force in atmospheres |
|---|---|---|
| 4.65 | — 0.53 | |
| 5.83 (air-dry) | 0.00 | Li Cl saturated = 965 atmospheres. |
| 5.95 | + 0.38 | |
| 6.66 | 0.97 | |
| 6.15 . . . . | 1.58 | |
| 6.23 . . . . | 1.91 | (697)* |
| 6.46 . . . . | 1.06 | |
| 7.61 . . . . | 3.73 | (532) |
| 7.85 . . . . | 3.35 | |
| 7.88 . . . . | 3.68 | |
| 8.27 . . . . | 5.18 | |
| 8.68 . . . . | 6.16 | (418) |
| 8.92 . . . . | 6.25 | |
| 9.16 . . . . | 6.55 | |
| 9.36 . . . . | 6.47 | Na Cl saturated = 375 atmospheres. |
| 10.26 . . . . | 9.58 | |
| 10.32 . . . . | 10.76 | |
| 10.81 . . . . | 9.81 | |
| 11.16 . . . . | 10.82 | |
| 11.60 . . . . | 15.79 | |
| 11.79 . . . . | 11.94 | 4 M. Na Cl = 130 atmospheres. |
| 12.46 . . . . | 15.81 | |
| 12.74 . . . . | 17.46 | |
| 13.16 . . . . | 21.36 | 2 M. Na Cl = 72 atmospheres. |
| 13.91 . . . . | 21.11 | |
| 14.23 . . . . | 23.88 | |
| 14.78 . . . . | 20.62 | |
| 14.88 . . . . | 28.61 | M. Na Cl = 38 atmospheres. |
| 15.18 . . . . | 32.60 | |
| 15.34 . . . . | 31.54 | |
| 16.06 . . . . | 34.00 | M. $C_{12}H_{12}O_6$ = 22.4 atmospheres. |
| 16.75 . . . . | 33.86 | |
| 17.10 . . . . | 37.70 | 0.5 M. Na Cl = 19 atmospheres. |
| 17.12 . . . . | 41.98 | 0.4 M. Na Cl = 15.2 atmospheres. |
| 17.35 . . . . | 39.77 | |
| 17.93 . . . . | 43.25 | 0.3 M. Na Cl = 11.4 atmospheres. |
| 18.07 . . . . | 41.79 | |
| 18.07 . . . . | 45.15 | 0.2 M. Na Cl = 7.6 atmospheres. |
| 18.87 . . . . | 47.26 | 0.1 M. Na Cl = 3.8 atmospheres. |
| 19.34 . . . . | 49.31 | |
| 19.71 . . . . | 43.79 | |
| 19.80 . . . . | 46.54 | |
| 10.04 . . . . | 50.00 | |
| . . . . . | 51.44 | Saturated = 0,00 atmospheres. |

* Values in parenthesis calculated from the curve of moisture-holding power of the soil as determined by the known value.

## Experimental Results.

A. *Measurement of the Seeds.* — The data resulting from the measurement of the internal forces of *Xanthium* seeds by means of NaCl and LiCl solutions are given in Table I and these figures may serve as a basis in the soil experiments, where the surface forces of the soil particles, instead of osmotic pressure are pitted against the internal forces of the seed.

B. *The Surface forces of Soils. — Soil No.* 1. The results of 4 of a number of tests made with the subsoil of the Oswego silt loan mentioned above are shown in Table II.

*Soil No.* 2. — The results af a series of tests with the fine quartz sand running from air dry (0.14 per cent) to a little beyond the wilting coefficient (1.3 per cent) are shown in Table III.

Table III. — *Relation of moisture in No.* 2 *Quartz Sand to Moisture Intake of Xanthium seeds*

| Soil $H_2O$ in percentage of absolute weight | Intake $H_2O$ in percentage of air-dry weight |
|---|---|
| 0.14 (air-dry) | — 0.306 |
| 0.159 | + 1.407 |
| 0.175 | 5.02 |
| 0.203 | 21.81 |
| 0.44 | 33.98 |
| 0.81 | 42.40 |
| 1.03 | 45.64 |
| 1.49 | 47.46 |
| 1.79 | 52.06 |
| 2.14 | 72.85* |

* Four seeds showing incipient germination, hypocotyls averaging 3 mm. long.

*Various soil types.* — The foregoing results suggested that there might be a general relationship between soils and seeds as regards the amount of moisture seeds will absorb at the wilting coefficient of the soil, whatever value the wilting coefficient might have. To clear up this point the soil types of Table IV were used. Each soil was brought as nearly to the wilting coefficient as possible by addition of water.

TABLE IV. — *Relation of wilting coefficient to moisture intake by seeds*

| Soil types | Percentage of hygroscopic moisture | Percentage of wilting coefficient | Percentage of soil $H_2O$ | Percentage of seed intake |
|---|---|---|---|---|
| 1. Sand (coarse) . . . . . | 0.205 | 0.73 ± 0.02 | 0.65 | 34.44 |
| 2. Loam . . . . . | 3.130 | 12.93 ± 0.05 | 12.66 | 49.02 |
| 3. Sandy loam (very fine). | 1.836 | 8.33 ± 0.08 | 7.86 | 48.38 |
| 4. Loam . . . . . | 2.280 | 12.41 ± 0.02 | 13.30 | 49.01 |
| 5. Clay loam . . . . . | 3.820 | 16.12 ± 0.01 | 16.01 | 49.49 |
| 6. Clay loam . . . . . | 5.210 | 16.34 ± 0.02 | 17.78 | 47.31 |
| 7. Fine sand . . . . . | 0.750 | 3.21 ± 0.03 | 3.19 | 49.77 |
| 8. Sand (coarse) . . . . . | 0.218 | 0.83 ± 0.01 | 0.80 | 40.98 |
| 9. Loam . . . . . | 2.30 | 10.82 ± 0.06 | 10.51 | 50.42 |

## CONCLUSIONS.

1) The force with which the seeds of *Xanthium pennsylvanicum* absorb water has been measured by two methods : (*a*) osmotic solutions, and (*b*) vapour pressure equilibrium. The osmotic method is at present the more reliable.

2) The air-dry seeds of *Xanthium* show an initial attraction for water of nearly 1 000 atmospheres.

3) The attraction which exists at any moisture content of the seed between air-dry and saturation can be approximated. See Table I.

4) The seeds have in turn been used to measure the complex moisture-holding forces of soils, with the following results :

*a*) The air-dry subsoil of the Oswego silt loam holds its hygroscopic moisture with about the same force as an air-dry seed, that is, about 1 000 atmospheres.

*b*) As the moisture content of the soil increases, the surface force decreases rapidly. When about 3.5 per cent of water has been added to the air-dry soil, the force remaining is about 395 atmospheres. When the soil moisture reaches 6 per cent above air-dry in this soil, the moisture is held with a force of 130 or more atmospheres. At 11 per cent above air-dry the holding power has fallen to 22.4 atmospheres.

*c*) At the wilting coefficient of the soil (13.3 per cent above air-dry in the Oswego silt loam subsoil) the " back pull " of the soil particles amounts to not more than that of a 0.1 M Na Cl solution, that is, not more than about 4 atmospheres. This is shown to hold true for a number of types of soil with widely varying wilting coefficients.

5) This water-holding power of soils at the wilting coefficient is less

than the osmotic pressure of the root hairs of many kinds of plants, as shown by HANNIG and others.

6) The wilting of plants at the wilting coefficient of the soil cannot be due to lack of moisture in the soil, nor to lack of a gradient of forces tending to move water toward the plant.

7) The view is held, therefore, that the wilting at this critical soil moisture content must be due to the increasing slowness of water movement from soil particle to soil particle, and from these to the root hairs, the rate of movement falling below that necessary to maintain turgidity of the cells of the aerial parts, even under conditions of low transpiration.

1060 – **The Treatment of Peat Beds to Prevent Loss of Nitrogen Due to Bacterial Activity (Germany).** — ARND, T. in *Landwirtschaftliche Jahrbücher*, Vol. 49, No. 2, pp. 191-213. Berlin, March 25, 1916.

At the Bremen station for peat investigations, experiments were carried out to determine whether denitrification and the decomposition of nitrates in peat beds could be prevented. The problem was attacked by two methods: (1) soil conditions were made such as to encourage nitrification and processes favourable to plant growth; and (2) the reduction of nitrates was inhibited by the use of germicides. By the first method denitrifying organisms alone were affected while by the second method the destruction of both denitrifiers and nitrate reducers was involved.

1*st. method.* — The soil used was from a well rotted peat bed, crumbly and rich in bacteria. On analysis it proved to contain fair quantities of ammonia and traces of nitrates, but no nitrites. The sample was put through the 3mm. sieve and mixed with pure calcium carbonate at the rate of 0.3 gm. of carbonate to 40 gms. of soil (these proportions having previously been shown to produce maximum nitrogen losses). The soil was watered to bring it up to its original water content and placed in glass vessels in layers 0.8 cm., 3 cms., and 9 cms., thick; 0.5 gm. of dry nitrate was added to each vessel which was then plugged with cotton wool and incubated for a fortnight at 28° C. The amount of denitrification which had taken place was then determined.

The results showed conclusively that denitrification varies with the depth of the soil layer in the vessels, *i. e.* with the amount of oxidation which can take place. In other words, the greater the relative surface exposed to the air, the more are the oxygen needs of the soil bacteria satisfied and the smaller the loss of nitrogen and the reduction of nitrates. The mean total loss of nitrogen for the three layers 9 cm., 3 cm., and 0.8 cm. were 17.8 mgms., 2.1 mgms, and 3.8 mgms. respectively. Where the soil was very loosely packed, no denitrification took place, but in other cases even thin layers of less than 1 cm. thickness showed losses of nitrogen, and it may be concluded that under field conditions where the soil could never have such a large surface exposed as in these experiments, denitrification could never be completely prevented.

In practice, therefore, tillage and drainage of peat soils may be always recommended in order to minimise denitrification, but some losses must always be expected from that cause.

*2nd. method.* — In the series of experiments where germicides were used, the same apparatus was employed, but the soil layers were uniformly 9 cms. thick. The germicides were mixed with the soil in the dry state or in solution at the rate of 25 to 200 mgms. per 60 to 70 gms. of soil (contaning 80 per cent of water).

*Copper sulphate.* — Even with the maximum doses of 0.2 gm. $CuSO^4$ $5H^2O$ per 12 gms. of dry soil, losses of nitrogen were not completely avoided. With the small doses, denitrification was intensified. This unexpected behaviour on the part of copper sulphate was probably due to the fact that the greater part of the salt is precipitated as humates in a peaty soil and thus loses its toxicity. The humates which are hardly ionised actually seemed to have a stimulating effect on the denitrifying bacteria.

*Magnesium sulphate and zinc sulphate.* — Neither of these salts totally inhibited denitrification. With zinc sulphate the action was diminished a little, but with magnesium sulphate it was nearly always slightly increased. Probably with both these salts too the results are due to the formation of non-ionised humates.

*Non-ionisable substances.* — In a last series of experiments, disinfectants which did not owe their germicidal properties to ions were used: *i. e.* carbolineum, toluene and carbon bisulphide. Where carbon bisulphide was used the period of incubation was increased from two to five weeks during which time the soil was maintained at ordinary room temperature instead of at 28° C. The following results were obtained: carbolineum increased denitrification; toluene had no stimulating effect in whatever proportion used but neither did it have an inhibitive effect except in one single instance; carbon bisulphide on the other hand always decreased denitrification even when used in very small doses.

It would therefore appear that on peaty land, carbon bisulphide may be recommended as the best germicide to employ.

1061 - **The Chemical Composition of Plants as a Guide to the Fertility of the Soil.** — SAVVIN P. in *Журналъ Опытной Агрономіи* (Review of Agricultural Experiments) Vol. XVII, No. 1, pp. 1-12. Petrograd, 1916.

Two series of investigations were carried out to determine the relationship between the phosphoric acid content of the plant and that of the soil in which it had been grown. In the first series oats were grown in sand to which nutrient solution was added. Each vessel contained 7 kg. of sand and the nutrient solution was that of Prianichnikoff, *i. e.* phosphoric acid in the form of $Ca\ HPO^4 + 2H^2O$ and nitrogen in the form of ammonium nitrate, both being used in the proportions laid down by Hellriegel. The solution was used at normal strength, double strength and treble strength. In the second series of experiments the sand was replaced by two soils, one of which was a poor sandy forest soil from the Agricultural Institute of Moscow and the other a tchernozium (black soil) from the Kharkov Agricultural Station, unresponsive to phosphate manuring. Calcium phosphate and potassium nitrate were added in quantities equal to normal strength and to 2, 4 and 8 times normal strength.

When the oat plants were harvested, the grain was separated from the

straw and both were analysed. It was found that the phosphoric acid content of the grain varied very little while that of the straw reflected to a much greater extent the phosphoric acid content of the culture medium. The sand cultures gave the following figures:

| | Phosphoric acid content | |
|---|---|---|
| | in straw | in grain |
| Normal strength | 0.6503 per cent | 0.2844 per cent |
| Double " | 1.458 " " | 0.2982 " " |
| Treble " | 1.834 " " | 0.2865 " " |

In the grain the phosphorus was present almost wholly in the form of organic compounds while in the straw only phosphates were found. The phosphate content of the plant, therefore, varied considerably according to the available amount of phosphoric acid in the culture medium, but the organic phosphorus remained almost constant varying only within the limits of 0.41 and 0.60 per cent. The organic phosphorus was not affected by the total weight of the plant and only to a slight extent by the amount of phosphoric acid absorbed by the plant. Where the nutrient solution was used in a concentrated form, considerable amounts of phosphoric acid were taken up by the plant, but only a very small portion of this was converted into organic compounds of phosphorus, the main part being deposited as phosphate in the straw.

From these results, it should be possible to draw the practical conclusion that a high percentage of phosphate in oat straw indicates the presence of a considerable amount of phosphoric acid in the soil. But it is pointed out that other causes such as general conditions of growth may also affect the percentage of phosphates in plants, indeed the writer's own experiments of 1913 and 1914 gave results directly contradictory to those obtained in the above trials and are supported by the evidence of other authorities (HALL, SEELHORST, ATTERBERG). On the whole, therefore, it cannot be considered that the determination of the phosphate content in oat straw affords a reliable guide to the condition of the soil, but in special cases it may yield useful information.

METHODS OF SOIL CULTIVATION

1062 – **The Influence of Relative Area in Intertilled and Other Classes of Crops on Crop Yield.** — BRODIE D. A. in *United States Department of Agriculture, Office of the Secretary, Circular* No. 57, pp. 1-8. Washington, March 31, 1916.

Experience has taught that there is a limit to the extent to which land may be occupied by the same class of crops without detriment to crop yield, and this experience has led to the adoption of rotations. Just what proportion of the crop should be planted to intertilled crop (*i. e.* corn, potatoes, tobacco, etc., planted in rows and cultivated between the rows), what to grain crops, and what to perennial grass, to prevent serious injury to the soil, are questions that the farmer has always had to answer for himself, largely from his own experience or from the established custom of his locality.

During the past two years studies as to the relation of the type of

farming to the maintenance of crop yield have been made on 240 farms in Chester County Pa., and on 303 farms in Central Illinois. Use has also been made of the data compiled for 377 other farms in Chester, Co. Pa. and 300 farms in Lenawee Co. Mich. The studies consisted in comparing the productive capacity of the various farms by means of their "crop index" which may be defined as the crop yields of a particular farm expressed in percentage of the average crop yields in the community.

Results of the investigations indicated:

1) That there seems to be in all districts so far studied an optimum percentage of the crop area of the farm which can be devoted to a single class of crops and maintain maximum yields. Even under the rather intensive types of farming prevailing in Chester Co. Pa. and in Lenawee Co. Mich., and under the more extensive type of farming in Central Illinois, the optimum area of intertilled crops in each case falls within 5 per cent of each other, the range being about 32 to 36.

2) That when more than this percentage of area is devoted to a single class of crops, yields decrease even where there is an increase in the number of live stock per acre.

3) That in Chester Co. Pa. the optimum percentage area for perennial grass (timothy and clover) is about 36 per cent of the crop area of the farm.

4) That data of this character make it possible to construct a cropping system which should under average conditions, produce maximum yields with a given quantity of manure. In the case of Chester Co. such a system constructed from data brought out in the 1912 survey corresponds very closely to the practice of those farmers who maintain high yields and of those who have made highest profits.

These conclusions were arrived at as follows: the relation between the crop yield, the percentage of the crop area of the farm in intertilled crops, and the average number of live stock per acre was determined for Chester Co. Pa. and for Central Illinois (Tables I and II).

The relation of non intertilled crops to crop yield was next investigated (Table III) and finally that of perennial grass (timothy and clover) to crop yield (Table IV).

The results show that the best distribution of area amongst the different classes of crops occurs when 10 per cent is allowed for crops not in the rotation such as garden, orchard, soiling crops etc., 36 per cent is under intertilled crops, 36 per cent in perennial grass and the remaining 18 per cent in annual crops not intertillied. To illustrate how nearly this corresponds to the actual practice of the most successful farmers, Table V shows the crop area percentages of the 27 Chester Co. farms having the highest yield and of the 27 having the lowest yield. There is a close agreement between the cropping systems selected for high crop yields andt hat producing the highest profits and this agreement indicates that a well balanced type of agriculture prevails in Chester Co. Where this condition does not prevail high yields are obtained to the sacrifice of profit or high profits are made at the sacrifice of soil fertility.

TABLE I. — *Relation of per cent of crop area in intertilled crops to crop index in Chester Co. Pa.* (1914 *survey*).

| No. of farm | Per cent of crop area in intertilled crops | | Average no. animal units (1) per 100 *acres* in crops | Average crop index |
|---|---|---|---|---|
| | Range | Average | | |
| 72 | Less than 25 | 20.8 | 37.6 | 96 |
| 58 | 25–30 | 27.4 | 41.2 | 100 |
| 53 | 30–35 | 32.7 | 48.4 | 105.2 |
| 57 | 35 or more | 41.4 | 53.4 | 104.7 |

(1) An animal unit is a mature horse or cow or as many smaller animals as require the feed of a horse or cow, *i. e.*, 2 head of young cattle; 5 hogs, 7 sheep, or 100 hens.

TABLE II. — *Relation of per cent of crop area in intertilled crops to crop index in Central Illinois* (1913 *survey*).

| No. of farms | Per cent of crop area in intertilled crops | | Average no. animal units per 100 *acres* in crops | Average crop index |
|---|---|---|---|---|
| | Range | Average | | |
| 75 | Less than 37.5 | 28.4 | 19.3 | 102 |
| 72 | 37.6–48.9 | 43.3 | 18.1 | 103 |
| 82 | 49.0–59.9 | 53.9 | 17.1 | 100 |
| 74 | 60 and over | 73.6 | 15.8 | 93 |

TABLE III. — *Relation between the per cent of the crop area in annual crops not intertilled and crop index in Chester Co. Pa.* (1914 *survey*).

| No. of farms | Percentage of the crop in annual crops not intertilled | | No. of animal units per 100 *acres* in crops | Average crop index |
|---|---|---|---|---|
| | Range | Average | | |
| 64 | Less than 18 | 14,2 | 51.9 | 105 |
| 73 | 18–24 | 26.0 | 44.5 | 102 |
| 48 | 24–30 | 26.9 | 39.8 | 99 |
| 53 | 30 and over | 34.9 | 36.8 | 97 |

TABLE IV. — *Relation of per cent of crop area in perennial grass to crop index in Chester Co. Pa.* (1914 *survey*).

| No. of farms | Per cent of crop area in perennial grass | | No. of animal units per 100 *acres* in crops | Average crop index |
|---|---|---|---|---|
| | Range | Average | | |
| 64 | Less than 32 | 22.9 | 46.7 | 102 |
| 48 | 32–39 | 34.7 | 44.8 | 105 |
| 57 | 40–45 | 41.7 | 44.2 | 102 |
| 69 | 45 and over | 51.7 | 40.8 | 98 |

TABLE V. — *Average percentage of area of intertilled crops, annual crops not intertilled, and perennial grass, Chester Co. Pa.,* (1914 *survey*).

| Class of crops | Average percentages | | | | |
|---|---|---|---|---|---|
| | On 240 farms | On 27 farms showing highest yields | On 27 farms showing lowest yields | Modified for : highest yields | Modified for : highest profits (1) |
| Intertilled . . . . . | 28.4 | 34.0 | 27.4 | 36 | 34–43 |
| Annuals not intertilled . . . | 22.3 | 18.8 | 23.4 | 18 | 10–19 |
| Perennial grass . . . . . | 38.0 | 38.2 | 39.4 | 36 | 40–50 (2) |
| Garden, orchard, etc. . . . . | 11.3 | 9.0 | 9.8 | 10 | — |

(1) The figures for this column are derived from a 1912 survey.
(2) All hay crops including annuals.

1063 – **"Tetraphosphate".** — VINASSA, G. (Turin Agricultural Experiment Station) in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLIX, Nos. 7-8, pp. 357-365. Modena, 1916. MANURES AND MANURING

"Tetraphosphate" is a new fertiliser recently put on the market, and has been suggested as a substitute for basic slag. It is prepared by mixing powdered phosphorite with carbonates of the alkaline earths (at the rate of 6 per cent by weight of the carbonates) and heating the mixture to 400° C. in special ovens. The mass is then moistened and inert bodies are added till a substance containing 20 per cent of total phosphoric acid is obtained. The finished product is a dry, greyish-white powder, almost insoluble in water with which it gives an alkaline reaction, and partly soluble in acids which cause an evolution of carbon dioxide.

"Tetraphosphate" was treated with a number of solutions and the solubility of its phosphoric acid was determined; similar tests with Sfax phosphorite were carried on at the same time. The results are given below.

*Comparative solubility of "tetraphosphate" and phosphorite.*

| Solvent | Grams $P_2O_5$ per 0.71 gm. phosphorite | Grams $P_2O_5$ per 1 gm. tetraphosphate |
|---|---|---|
| Water | trace | trace |
| Water saturated with $CO_2$ | " | " |
| Saline solutions (NaCl and $NaNO_3$, $NH_4Cl$ and $(NH_4)_2SO_4$) | " | " |
| Ammonium acetate 18 % | 0 0009 | " |
| Ammonium malate 40 % | 0 0009 | " |
| Ammonium tartrate 20 % | 0 00016 | 0 00015 |
| Ammonium citrate 40 % | 0 0163 | 0 0100 |
| Citric acid 0.5 % | 0.0225 | 0.0106 |
| Citric acid 2 % | 0.0529 | 0.0282 |
| Citric acid 10 % | 0.1217 | 0.1041 |
| "Citroformic" acid (4 % citric acid, 6 % formic acid, 10 % NaCl) | 14.04 per cent | 13.79 per cent |

"Citroformic" acid was proposed as a reagent by the inventor of "tetraphosphate", yet even with this solvent, phosphorite shows a higher percentage of soluble phosphoric acid than does "tetraphosphate", and with all the other solvents the same thing was observed. These results would indicate that no valuable changes take place when the phosphorite is heated with the carbonates of the alkaline earths, and that the process which is complicated and costly is also useless. The name "tetraphosphate" is very inappropriate as its insolubility clearly proves it to contain neither tetraphosphate nor calcium silicophosphate both of which products have been isolated from basic slag, by HILGENSTOCK and CARNOT. From the purely chemical point of view, there is no analogy between basic slag and "tetraphosphate" which may be simply considered a ground phosphate mixed with inert compounds.

Occasional satisfactory results obtained by farmers with this substance and said to demonstrate its particular efficiency should be looked upon as inconclusive.

1064 – **Lucerne Inoculation Experiment, Hawkesbury Agricultural College (New South Wales) 1912-16.** — HEINRICH J. O. in *Agricultural Gazette of New South Wales*, Vol. XXVII, No. 5, pp. 305-313. Sydney, May, 1916.

An experiment was conducted at the Hawkesbury College during the years 1912-16 to contrast the various methods of inoculation for lucerne on manured and unmanured land and to ascertain their practical value in establishing lucerne on soil which had not previously borne it. The ground chosen for the experiment was a plot of well drained, uniform, red sandy loam. Methods of inoculation were as follows:

1. Inoculation of seed with lucerne rhizobia.
2. " " soil " " " before sowing.
3 " " " " " " after germination
3a " " " " " " when half grown.
4 " " " " soil of similar composition from an established lucerne area.
5 " " " " " soil of dissimilar composition from an established lucerne area
6. " " seed with vetch rhizobia.

TABLE I. — *Result of examination for nodules three months after sowing.*

| Method of inoculation | Manure | No. of plants examined | Plants with nodules on roots | | Remarks |
|---|---|---|---|---|---|
| | | | Number | Per cent | |
| Check | | 44 | 0 | 0 | |
| Inoculated after germination. | No manure | 69 | 12 | 17 | Fairly large; 3-4 on a plant. |
| | Lime | 70 | 55 | 79 | Large to medium; scattered; average 5. |
| | Complete manure | 70 | 15 | 21 | Large size; scattered. |
| Check | | 75 | 0 | 0 | |
| Check | | 83 | 2 | 2 | |
| Inoculated before sowing. | No manure | 70 | 2 | 3 | |
| | Lime | 128 | 107 | 84 | Medium; scattered; average 6. |
| | Complete manure | 84 | 6 | 7 | Scattered. |
| Check | | 66 | 1 | 2 | |
| Check | | 69 | 1 | 1 | |
| Seed inoculated with lucerne rhizobia. | No manure | 69 | 0 | 0 | |
| | Lime | 52 | 7 | 15 | Small; average 5. |
| | Complete manure | 63 | 5 | 8 | |
| Check | | 77 | 0 | 0 | |
| Check | | 64 | 0 | 0 | |
| Not inoculated. | No manure | 62 | 0 | 0 | |
| | Lime | 75 | 1 | 1 | |
| | Complete manure | 66 | 0 | 0 | |
| Check | | 76 | 0 | 0 | |
| Inoculated with soil of the same composition. | Complete manure | 89 | 55 | 62 | Average 6; scattered. |
| | Lime | 85 | 82 | 96 | » 7; » |
| | No manure | 94 | 79 | 84 | » 6; » ; at top. |
| Inoculated with soil of different composition. | Complete manure | 74 | 4 | 5 | |
| | Lime | 85 | 56 | 64 | Average 3; scattered. |
| | No manure | 78 | 6 | 8 | Scattered. |
| Check | | 62 | 0 | 0 | |
| Check | | 97 | 0 | 0 | |
| Check | | 72 | 0 | 0 | |
| Seed inoculated with vetch rhizobia. | No manure | 64 | 0 | 0 | |
| | Lime | 72 | 0 | 0 | |
| | Complete manure | 73 | 0 | 0 | |

TABLE II. — *Relative yields of lucerne* 1913-14, 1914-15.

| Method of inoculation | Manure | Relative yield, check plot = 100 |
|---|---|---|
| Inoculated after germination | No manure | 86.03 |
| | Lime | 105.66 |
| | Complete manure | 102.88 |
| Inoculated before sowing | No manure | 86.01 |
| | Lime | 106.72 |
| | Complete manure | 119.51 |
| Seed inoculated with lucerne rhizobia | No manure | 74.72 |
| | Lime | 112.82 |
| | Complete manure | 117.03 |
| Not inoculated | No manure | 85.36 |
| | Lime | 115.79 |
| | Complete manure | 115.16 |
| Inoculated with soil of same composition | Complete manure | 94.52 |
| | Lime | 107.14 |
| | No manure | 102.29 |
| Inoculated with soil of different composition | Complete manure | 100.63 |
| | Lime | 117.35 |
| | No manure | 106.58 |
| Seed inoculated with vetch rhizobia | No manure | 89.64 |
| | Lime | 102.51 |
| | Complete manure | 99.34 |

The land after being carefully prepared, was divided up so that each method of inoculation except 3*a* was tried with: *a*) no manure, *b*) lime at the rate of one ton per acre and *c*) complete manure (1 cwt. superphosphate, ½ cwt. sulphate of potash, ½ cwt. sulphate of ammonia per acre). About three months after sowing, samples of roots were examined for nodule formation with the results given in Table I. Ten months after the laying down of the experiment another examination was made for nodules. The results obtained were similar to the previous ones, but it was evident that the earlier examination was the more reliable as the older the plant the deeper are the fine roots on which the nodules are found and the greater the difficulty in uprooting them. Moreover if the treatment is efficacious, nodules will be found on the young plant as early as six months after germination. Finally in February and March 1916, four years after the begin-

ning of the experiment, a further examination for nodules was carried out. By this time all the plots contained lucerne rhizobia.

From Table I it will be seen that:

1) The method of artificial inoculation with cultures of lucerne rhizobia are far from being as efficient nodule producers as the inoculation with soil of the same composition as the land being treated.

2) Inoculation with rhizobia from a legume other than lucerne is ineffective when used with the latter crop.

3) The addition of lime greatly increases the nodule forming power.

Whereas these deductions are in full accord with those of other investigators, the present experiments gave results different from those obtained in other parts of the world as regards yield. In Table II will be found the figures for the 1913-14 and 1914-15 harvestings from which it is evident that inoculation had a depressing effect on the yield when used alone or in conjunction with lime or complete manures.

1065 - **The Application of Botanical Science to Agriculture.** — HOWARD ALBERT (Imperial Economic Botanist, Pusa) in *The Agricultural Journal of India*, Special Indian Science Congress Number pp. 14-26. Calcutta and London, 1916.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS

A study of the literature dealing with agriculture indicates that there is some confusion of ideas as to the precise relation which exists between the science of botany on the one hand and the practice of agriculture on the other. In the present paper, an attempt has been made to define the bearing of the scientific aspect of the vegetable kingdom on the economic development of crop production and to show how a knowledge of this science can best be applied to agricultural problems. For any real advance to be made in crop-production, a thorough scientific knowledge of botany in all its branches is one of the first conditions of progress. This will be clear if the real problems to be solved are considered in all their bearings.

The attempt to improve cultivated crops by scientific methods is a recent development and can be traced to two main causes — (1) the gradual recognition of the fact that in agriculture the plant is the centre of the subject ; and (2) the rapid rise of the study of genetics which followed the rediscovery of Mendel's results in inheritance.

The importance of the plant in crop production may be said to be generally recognized at the present time. A large number of botanists are being employed at Experiment Stations and the public have often been led to expect that a revolution is about to take place, particularly through the application of what is popularly known as Mendelism. A critical examination of the literature discloses some signs that these extravagant hopes are not likely to be fulfilled, not that these hopes are impossible but rather because the problems have not always been taken up on a sufficiently broad basis and attacked simultaneously from several standpoints.

II. *The Development of Botany.*

The more recent developments in botanical science are fortunately all tending to a study of the plant as a living whole. Both the scientific study in the field of plant associations (ecology) and the systematic examination of the various generations of plants raised from parents which breed true

(genetics) are doing much to mitigate the evils which follow from undue devotion to purely laboratory work. Ecology and genetics are taking the botanist into the field and will, in all probability, materially influence the future development of the science. This will be all to the good and should do much both to raise the standard and emphasize the importance of field work and also develop the natural history side of botany. The botany of the future is likely to combine all that is valuable in laboratory work with modern ideas on ecology, classification, and genetics.

*The relation of Botany to Agriculture.*

A wide scientific outlook on the many aspects of plant life is the first condition in applying botanical science to practical problems. The next step for the botanist is to study his crop in the field and to learn to appreciate the agricultural aspects of crop-production. The investigator must himself be able to grow his crop to perfection and it is not too much to say that no real progress can be made without this. The ordinary agricultural processes applied to any crop bear a direct relationship to the physiological necessities of the plant and have been evolved from centuries of traditional experience. In all investigations on crops, a first-hand knowledge of practice is necessary and nowhere is it so important as in plant-breeding work where practice is quite as valuable as an acquaintance with the methods and results of genetics. The greatest devotion to the study of inheritance, using for this purpose material indifferently grown, is largely labour lost as many characters are masked unless the plants are really thriving and well developed. For instance in wheat, the red colour of the chaff never develops in badly grown plants thereby causing great confusion in systematic and breeding work on this crop. In tobacco, the various leaf characters are almost entirely masked by bad cultivation and their inheritance can only be studied if the crop is grown to perfection.

Science and practice must be combined in the investigator who must himself strike a correct balance between the two. The ideal point of view of the improver is to recognize agriculture as an art which can best be developed by that instrument called science. Once this is fully realized and acted upon, the place of the experiment station in agriculture will be understood as a matter of course and the qualifications needed by the workers will be self-evident. There will be little or no progress if practical agriculturists are associated with pure scientists in economic investigations. This has often been tried and has never yielded results of any importance. The reason why such co-operation fails is that without an appreciation of practice the scientist himself never gets to the real heart of the problem. The history of the indigo investigations in India is a very good case in point. During the last 20 years, a number of scientists have been employed in an endeavour to improve the production of natural indigo. Over £50,000 have been expended on this work between 1898 and 1913 but no results have been obtained, largely because the scientists preferred to engage European assistants on indigo estates to grow their experimental crops rather than to cultivate them themselves. The result was that the real problems were not discovered, a large amount of ineffective work was done and valuable

time was lost during which the natural indigo industry declined and the synthetic product rapidly established itself in the markets of the world. The solution of the indigo problem has recently been disclosed by a study of the plant in the field. It is not too much to say that if a properly qualified botanist with a knowledge of agriculture had attacked the indigo problem twenty years ago, the history of this industry would have been very different.

There remains for consideration the commercial aspect of investigations on crops and the necessity, on the part of the worker, of keeping in close touch with the requirements of the trade. Particularly is this important in the case of materials used in textile industries like cotton where any marked alteration in the raw product might easily involve extensive changes in machinery. In the case of cereals like wheat, it is necessary in improving the variety to follow closely the needs of the manufacturer and to ensure that any new types introduced into general cultivation can be milled to advantage. The successful merchant often possesses information which is of the greatest value to the botanist and which helps the investigator to perceive the manner in which an improvement can most effectively be made.

That a combination of science, practice, and business ability in the same individual is essential in all agricultural investigations dealing with the plant will be evident if the kind of problem awaiting solution is considered in detail. Many of these questions fall into the following three classes :

(1) *Improvements in the efficiency of the plant.* — Any attempt to increase the output of a crop can only be successful if the the physiology of the plant is considered together with the economic aspects of production. Such problems have to be solved within the working conditions of the plant factory and also within the general economic limits imposed by labour and capital. In such matters, the investigator might easily go astray unless he keeps the laws of plant physiology in view and unless he is fortified by a knowledge of practice and an appreciation of the general working conditions.

(2) *The treatment of disease.* — The inadequacy of much of the experiment station work on the diseases of plants, in which fungi and insects are concerned, has recently been referred to by Professor Bateson in one of the sectional addresses to the British Association.

In the course of his speech, this gentleman drew attention to the fact that there is at the present time hardly any comprehensive study of the morbid physiology of plants comparable with that which has been so greatly developed in application to animals. The nature of the resistance to disease, characteristic of so many varieties, and the methods by which it may be ensured, offer a most attractive field for research, but it is one in which the advance must be made by the development of pure science, and those who engage in it must be prepared for a long period of labour without ostensible practical results.

(3) *The creation of improved varieties.* — In this work an understanding of the needs of the crop and a knowledge of systematy and genetics must

be combined with the insight of the inventor, no possible scientific method can succeed without the intuition of the breeder. Any attempt to obtain or record the characters of large numbers of plants and to obtain the final selections by a scientific system of marks is hopeless, as the investigator would be a speedily swamped by the volume of his material. The insight of the breeder is necessary for the work and the judgment, which comes by practice, in the rapid summing up of essentials by eye is far more useful than the most carefully compiled records or any system of score cards. The successful plant breeder is to a large extent born and not made. Science helps the born breeder by providing him with new and better instruments and, by bringing knowledge to bear from many sides, it accelerates the output and lightens the work in a multitude of ways.

1066 – **A Biochemical Study of Nitrogen in Certain Legumes.** — WHITING, A. L. *University of Illinois, Agricultural Experiment Station, Bulletin* No. 179, pp. 471-542. Urbana, Ill., March 1915.

The writer discusses the whole question of nitrogen fixation by leguminous plants and gives an account of his own experiments on the subject. These he divides into two parts:

I. *Studies to determine through which organ legumes obtain atmospheric nitrogen.* The plants used were the soybean (*Glycine hispida* Maxim) and the cowpea (*Vigna unguiculata* Walp). Uniform seeds were carefully selected and inoculated with an infusion of *B. radicicola.* The plants were grown in silver sand to which a nutrient solution was added, both sand and solution being free from nitrogen. Wolf bottles were used as containing vessels in order that the atmosphere around the roots should be controlled, and whereas the roots of some plants were maintained in a gas current consisting of 96 to 98 per cent of oxygen and 2 to 4 per cent of carbon dioxide, others were maintained in a current of air. At the end of each experiment the nitrogen was estimated in each plant, and the amount fixed was determined. Results are given in Tables I and II.

The error in soybeans nos. 1 and 2 was partially accounted for by a slight injury to these plants by grasshoppers and red ants. There was also a small experimental error. The fixation shown by cowpea no. 2 was also attributed to a leak around the stem which prevented the Wolf bottle from being gas tight. All plants receiving air had well developed nodules.

The experiments were repeated and the results were confirmed. In order to test the viability of *B. radicicola* after exposure to the abnormal atmosphere, infusions were made from the roots of plants grown in the oxygen current and applied to cowpea seeds that had been sterilized and planted in sterile sand. Sterile conditions were maintained throughout the test. Profuse nodule formation resulted, showing that the viability of *B. radicicola* had been in no way impaired.

Plants grown in the oxygen current usually developed two and sometimes three leaves before they seemed to be checked in their growth. Soon an interesting translocation set in. Each plant removed the nitrogen from the lower leaves and developed a new leaf of a normal green colour.

TABLE I. — *Fixation of nitrogen by soybeans.*

| No. of plant | Treatment | Nitrogen in plant after 28 days | Nitrogen in seeds | Nitrogen fixed |
|---|---|---|---|---|
| | | mgms. | mgms. | mgms. |
| 1 | $CO^2 + O$ | 10.43 | 11.4 | — 0.97 |
| 2 | $CO^2 + O$ | 10.65 | 11.4 | — 0.75 |
| 3 | Air | 17.61 | 11.4 | + 7.07 |

TABLE II. — *Fixation of nitrogen by cowpeas.*

| No. of plant | Treatment | Nitrogen in plant after 37 days | Nitrogen in seedlings at start | Nitrogen fixed |
|---|---|---|---|---|
| | | mgms. | mgms. | mgms. |
| 1 | $CO^2 + O$ | 9.21 | 7.90 | 1.31 |
| 2 | $CO^2 + O$ | 13.03 | 7.90 | 5.13 |
| 3 | $CO^2 + O$ | 9.43 | 7.90 | 1.53 |
| 4 | Air | 24.84 | 7.90 | 16.94 |
| 5 | Air | 23.61 | 7.90 | 15.71 |

TABLE III. — *Total nitrogen in various parts of soybeans and fixation at different periods (gms. per jar of 5 plants).*

| Harvest | Age of plant | Nitrogen in tops | Nitrogen in roots | Nitrogen in nodules | Nitrogen in whole plant | Nitrogen in seeds | Nitrogen fixed |
|---|---|---|---|---|---|---|---|
| | days | | | | | | |
| 1 | 38 | 87.10 | 13.35 | 28.04 | 128.49 | 57.30 | 71.19 |
| 2 | 53 | 204.59 | 22.70 | 47.10 | 274.39 | 57.30 | 217.09 |
| 3 | 60 | 286.91 | 43.44 | 82.95 | 413.30 | 57.30 | 356.00 |
| 4 | 67 | 356.52 | 40.15 | 60.40 | 457.07 | 57.30 | 399.77 |
| 5 | 74 | 247.82 | 30.82 | 54.56 | 333.20 | 57.30 | 275.90 |

The green of the old leaves disappeared from the margins first, then the whole leaves became yellow and dropped from the plant. The process repeated itself until there was not nitrogen enough left to give colour to another leaf, when a pale green or even a yellow leaf was formed. The whole appearance of the plants was very characteristic.

II. *Relative percentages of nitrogenous compounds in the various parts of the soybean and cowpea at definite periods of growth.* — Determinations of total, soluble and insoluble nitrogen were made on the dry matter of plants grown under specially controlled conditions. Total

TABLE IV. — *Analysis of nitrogen in soybeans (mgms per jar of 5 plants).*

| Harvest | Part of plant | Insoluble nitrogen | Total soluble nitrogen | Nitrogen distilled with Na OH | Nitrogen ppted by phospho tungstic acid | Other soluble nitrogen | Total nitrogen |
|---|---|---|---|---|---|---|---|
| 1. . . . | top | 61.52 | 24.39 | — | 4.16 | 20.23 | 85.91 |
| | root | 8.90 | 5.00 | — | 0.85 | 4.15 | 13.90 |
| | nodules | 15.72 | 11.61 | — | 3.54 | 8.07 | 27.33 |
| 2. . . . | top | 135.15 | 37.99 | — | 8.11 | 29.88 | 173.14 |
| | root | 15.49 | 5.67 | — | 0.48 | 5.19 | 21.16 |
| | nodules | 32.83 | 16.03 | — | 9.66 | 6.37 | 48.86 |
| 3. . . . | top | 146.79 | 140.12 | — | 25.63 | 114.49 | 286.91 |
| | root | 27.03 | 16.42 | — | 0.93 | 15.49 | 43.95 |
| | nodules | 47.95 | 35.00 | — | 18.55 | 16.45 | 82.95 |
| 4. . . . | top | 183.35 | 134.26 | 17.86 | 25.96 | 90.44 | 317.61 |
| | root | 26.14 | 12.93 | 2.49 | 0.85 | 9.59 | 39.07 |
| | nodules | 31.77 | 27.27 | 2.38 | 15.35 | 9.54 | 59.04 |
| 5. . . . | top | 151.68 | 95.32 | 12.02 | 29.31 | 53.99 | 247.00 |
| | root | 21.55 | 14.38 | 1.34 | 1.38 | 11.66 | 35.93 |
| | nodules | 29.23 | 27.21 | 2.00 | 12.13 | 13.08 | 56.44 |

nitrogen was estimated by the Joldbauer method ; insoluble nitrogen represented that part left undissolved after prolonged shaking with water ; soluble nitrogen was divided into the nitrogen precipitated by phosphotungstic acid, the nitrogen in the filtrate from this precipitate and a further fraction obtained by distilling the water soluble nitrogen with sodium hydroxide. Results are given in Tables III and IV.

The experiments were repeated with soybean and with cowpeas and the following conclusions were drawn :

(1) The total nitrogen determinations show that about 74 per cent of the nitrogen of the cowpeas and soybeans at the time of harvest is in the tops, while the remainder is distributed between the roots and the nodules. In the earlier periods the roots contain the larger part while later they contain much the smaller part.

(2) The percentage of soluble nitrogen in soybeans and cowpeas varies with the different parts of the plant and with the period of growth. In these experiments the soluble nitrogen, as an average, constituted in the tops about 45 per cent of the total nitrogen ; in the roots 34 per cent ; in the nodules of the soybeans 1 per cent, and in the nodules of the cowpeas 34 per cent.

(3) Phosphotungstic acid usually precipitates some form of nitro-

gen. In some cases the amounts precipitated vary widely, while in others the agreement is close. In these series the nitrogen precipitated by phosphotungstic acid averaged in the tops of both soybeans and cowpeas about 12 per cent of the total nitrogen; in the roots 5.5 per cent; in the nodules of the soybeans 1 per cent and in the nodules of the cowpeas 17 per cent.

(4) Other forms of soluble nitrogen than those precipitated by phosphotungstic acid and sodium hydroxide occur. In these series they constitute an average in the tops of both soybeans and cowpeas about 68 per cent of the soluble nitrogen; in the roots 77 per cent; in the nodules of the soybeans 89 per cent, and in the nodules of the cowpeas 53 per cent.

(5) Fixation takes place at a very early period in the growth of the seedling—sometimes within 14 days. It is rapid in some cases, especially with cowpeas.

(6) Plants grown under the conditions of these experiments contain no ammonia, nitrites or nitrates, as measured by the most accurate chemical methods.

1067 – **The Effect of Heavy Dressings of Mineral Salts on the Development and Structure of Plants.** — WARNEBOLD, H. in *Landwirtschaftliche Jahrbücher*, Vol. 49, No. 2, pp. 215-234. Berlin, March 25, 1916.

In order to investigate the harmful effects of mineral salts when applied in excessive quantities, plants were grown in pot cultures and as soon as they were past the seedling stage, Wagner P. K. N. salt (containing 8.3 per cent of nitrogen, 26.8 per cent of potash and 17.5 per cent of phosphoric acid) was added to the pots in successive dressings which were continued even after injury to the plants had been observed. The plants were then left in the pots another few weeks before being removed for examination—anatomical and morphological. The actual amount of salts applied was not determined accurately as the object was merely to injure the plants by over manuring. An ordinary garden soil was used in all cases but one *i. e. Helianthus annuus* which was cultivated in silver sand mixed with nutrient salts. Controls fed so that normal development could take place were grown in all instances. The plants selected for the trials were: *Cucurbita Pepo, Helianthus annuus, Raphanus caudatus, Atriplex hortensis, Fagopyrum esculentum, Phaseolus vulgaris nanus, Borago officinalis, Datura Stramonium, Tropaeolum majus, Rumex alpinus.*

The results showed that the critical or harmful dose of Wagner salt varied with the species of plant. Their order of sensitiveness was as follows: *Atriplex, Cucurbita, Datura, Helianthus, Tropaeolum, Rumex, Raphanus, Borago, Fagopyrum.* Also the amount of injury done varied with individuals and with the degree of humidity in the air, though no generalisations can yet be made with regard to the latter observation.

Leaving aside leaf modifications it may be said in a general way that large doses produced similar results in all the species employed. Normal development was always checked, and the plants were all more or less dwarfed. It should be pointed out, however, that with *Cucurbita, Phaseolus* and *Datura* growth was at first stimulated, especially leaf growth,

but that this ceased after the first few applications of salts. Stem development both as regards length and thickness was retarded, but the lower internodes were not shortened to the same extent as the upper ones, probably owing to the fact that the plant was less unhealthy in the early than in the later stages of its life. *Raphanus* stems were less straight, the angles were more marked at the point of attachment of each leaf. As a rule flowering and side branches behaved exactly like the main stem, but in *Phaseolus* the branches were larger in proportion. In all cases both stem and branches were greener than in control plants. The time of flowering varied with different plants, the flowers being always dwarfed.

While the development of the lower leaves was usually normal, the growth of the upper ones was poor. Leaf blades and petioles were affected. leaf blades being frequently bent and twisted. The leaves were also darker green in the initial stages, but this difference gradually faded away. Stomates were smaller than in normal plants. The root system was stunted by large doses of mineral salts.

Anatomical examination revealed the following differences between normal and injured plants: In the stem, the cortex cells were smaller; the chlorophyll content was higher; the formation of starch, tannin and oxalate was less active. In the leaves the same differences were observed; the leaf-blades were also thicker and while the smaller size of all cells was noticeable it was especially marked in the epidermis and in the palissade tissue. *Raphanus* besides containing more chlorophyll also had larger chromophores.

In a small number of trials, the pots were lixiviated after a certain time to remove the excess of salt and the plants were allowed to develop under normal conditions. Recovery occured in direct proportion to the amount of injury which the plant had suffered.

1068 – **Nitrogen Requirements of the Olive Tree.** — PETRI, L. in *Atti della Reale Accademia Economica Agraria dei Georgofili di Firenze*, Vol. XCI,V, pp. 138-147. Florence, July, 1916

The writer has shown in previous investigations on *Olea europea* (1. that all members of that species, wild or cultivated, growing on poor or rich soil, invariably bear a certain number of flowers in which the ovary is not completely differentiated and that imperfect flowers such as these fail to fruit. In normal plants the cause of the abortion lies with the supply of nitrogenous substances in the flowering branches which is not sufficient to meet the requirements of all the flowers produced. Lack of soil moisture is also an indirect cause, for by injuring both roots and leaves, it interferes with the transpiration current and thus prevents the transport of sufficient nitrates to the flowering branches for the proper development of all ovaries. The difference between the nitrogen content of a perfectly fertile branch and that of one bearing nothing but flowers with abortive ovaries has proved to be considerable; while the former was shown to contain from

(1) PETRI L. Studi sulle malattie dell'olivo. V. Ricerche sulla biologia e patologia dell'olivo. *Memoria della R. Stazione di Patologia vegetale, V*, pp. 5-64. Roma, 1914. See also *B.* 1915, No. 108.

2.119 to 2.370 per cent of nitrogen in the dry matter, the latter only contained from 0.724 to 0.924 per cent. The phenomena can also be interpreted as a stimulation to over-production of flowers correlated with a scarcity of nitrogen in the flowering branches.

The present investigations were directed to a further study of the contributing causes and more particularly to the part played by the " mycotropic " rootlets as nitrogen storers. These " mycotropic " rootlets or rootlets or endotropic mycorhiza are caused by the presence of a symbiotic fungus in the cortical parenchyma of the root; they can like normal rootlets absorb nitrates from the soil solution by means of hairs; but where as the nitrates absorbed by normal rootlets are passed directly through the cortical parenchyma to the distributing vessels of the central cylinder, the nitrates absorbed by mycorhiza are immediately changed to complex organic compounds for the benefit of the endophitic mycelium which feeds on these substances and on the starch found in the adjoining cells.

A large number of experiments were carried out from which the following results may be summarised:

(1) In a soil containing little organic matter, whenever nitrates were formed in small quantities, *i. e.* lower than the usual percentage in non-manured soils, mycorhiza were found in large numbers, their development varying inversely with the amount of available nitrogen in the soil. Also there was always a proportional reduction in the growth of normal rootlets. No nitrate reaction (1) was obtained from the mycotrophic roots in these cases.

(2) When nitrates were present in quantities up to but not exceeding those usually present in a good non-manured soil, about one third of the rootlets were transformed into mycorhiza. No nitrate reaction was obtained from the mycorhiza.

(3) When nitrates were present in large quantities, very few mycorhiza were formed and those few gave a positive nitrate reaction. In these cases the rapidity of growth of the normal rootlets prevented the fungus infection to a large extent, and even where the fungus managed to penetrate into the root and to develop, the mycorhiza was not able to seize and fix all of the nitrate absorbed by the root.

These facts demonstrate the effect of endotrophic mycorhiza on the olive trees with regard to the *interception of nitrates* and identical results have been obtained when the nitrogen was absorbed in the form of ammonia. Moreover once the nitrogen has been converted into organic compounds only a minute portion of it ever goes back into circulation in the host plant, even when the intercellular hyphae which are rich in albuminoids are subjected to autolysis or digestion.

The interception of nitrogen must accentuate the ill effects of a poor soil on olive trees more especially as in such soils the development of mycorhiza is particularly active. Practical trials have shown that on well manured soils only 30 to 40 per cent of the rootlets are transformed into

(1) Nitrates were tested by the Molisch method. (*Ed.*).

mycorhiza while on a hungry arid soil the number may rise to 98 per cent. And the condition of the roots is always reflected in the number of flowers with abortive ovaries. Further, where the nitrogen supply is so limited, the whole vegetative growth of the olive tree suffers. Sandy soils poor in lime and organic matter and liable to long periods of drought are particularly favourable to the development of mycorhiza, whereas rich calcareous soils stimulate the growth of normal roots.

Experiments were also carried out to determine whether the endoradical mycelium intercepted phosphoric acid. No interference in absorption and transport was observed.

Olive trees whose flowers are almost all sterile do not regain their fertility even when generously manured and this fact would indicate that the flowering branches, after being submitted to a prolonged course of malnutrition, undergo profound physiological modifications which are irreversible. Further investigations are required to establish whether the change is really complete, or whether the trees would eventually recover with time and treatment. The nitrogenous manures which are specially useful to stimulate the formation of a normal root system are those directly available to the plant and owners of olive groves should be encouraged to dress their groves periodically with such fertilizers.

PLANT BREEDING

1069 – **Correlated Characters in Maize Breeding.**— COLLINS, G. N. in *Journal of Agricultural Research*, Vol. VI., No. 12, pp. 435-453 + tables XLV - LXIII. Washington, D. C., June 19th, 1916.

Two principal methods of breeding can be distinguished, depending on the manner in which selection is carried out :

(1) Selection may aim at the isolation and propagation of desirable types of individuals.

(2) Selection may be directed towards the variation of individual characters, regarding which improvement is required.

With the majority of crop plants the method of selection of types has been by far the most productive, but this method has been very little used in the improvement of maize. Selection has been by characters instead of types.

It has not been clear why the isolation of types of plants has not been a factor in the improvement of maize. Although the differences in the characters are very clear and striking, few breeders have been able to distinguish well defined types of plants within the commercial varieties. If recognizable types exist, it must mean that groups of characters tend to appear together : in other words, the characters are correlated. The extent to which obvious characters are correlated is therefore proposed as a measure of this tendency towards the persistence of types. The experimental results here reported show that in the progeny of a hybrid between two very different varieties of maize, the characters studied, instead of forming coherent groups, are almost entirely independent in inheritance.

In attempting to measure the extent to which types persist by means of correlation coefficients, it is necessary to distinguish different kinds of correlations. For this purpose correlations are here classified as physical,

physiological and genetic. A method is also proposed by which physiological and genetic correlations may be distinguished. *Physical correlations*, are those in which the relation of cause to effect is evident, that is to say, in which one character is a function of another (for example when an increase of weight is correlated with increased height). *Physiological correlations* are those in which two characters are both the result of the same physiological tendency, as when long internodes in the primary stem are correlated with long internodes in the branches. *Genetic correlations* comprise the large residue of correlations, the nature and causes of which are subject to controversy, but which are associated with the method or mechanism of heredity. In order to determine with certainty that a given correlation is physiological and not genetic, it would be necessary to demonstrate the existence of the correlation in a number of subjects in which all the individuals possessed the same hereditary tendencies with respect to the characters studied. Theoretically this is only possible in asexually propagated groups. Approximately pure lines can be obtained where selfpollination is possible, so that if correlations are found, they may with assurance be considered physiological. With maize, however, even approximately pure lines present such abnormal conditions that some other method of study must be sought. For this plant it would seem that the solution of the question might be approached by comparing the degree of correlation in types or varieties having a relatively restricted ancestry with that in several generations of hybrids crossed among themselves and derived from two contrasted types. An equally satisfactory method is to compare the degree of correlation in the hybrid of the first generation with that of the generations obtained by crossing the hybrids among themselves. If the first generation is all descended from a single cross, its gametic differences should be no greater than those of the progeny obtained by self-pollination.

The hybrid that afforded the data for the present paper was a cross between "Waxy Chinese" and "Esperanza", two varieties of maize separated by a number of definitely contrasted characters. These extreme types must have been completely isolated from very remote times. The hybrid was made at Lanham, Md. in 1908. The plant of Waxy Chinese used as female parent of the hybrid was grown from the original seed imported from China. The Esperanza variety belongs to a peculiar type of maize (*Zea Hirta* of Bonafous) that appears to be confined to the table lands of Mexico. The characters of the two varieties presenting the sharpest contrast are as follows.

| "*Esperanza*" | "*Waxy Chinese*" |
|---|---|
| Horny endosperm | Waxy endosperm. |
| Branching space short | Branching space long. |
| Tassel erect | Tassel curved. |
| Spikelets of the male inflorescence in whorls of 2 to 5. | Spikelets of the male inflorescence inserted in pairs. |
| Glumes long. | Glumes short. |
| Leaf sheaths with tuberculate hairs. | Leaf sheaths without tuberculate hairs. |
| Upper leaf blades horizontal. | Upper leaf blades erect. |
| Upper leaf blades distichous. | Upper leaf blades monostichous. |

The large number of well defined characters which differentiate the two varieties rendered this material exceptionally favourable for the study of coherence, by which is meant the tendency for characters associated in one parent of a hybrid to remain together in the later generation of the hybrid.

For the study of correlations 11 characters were selected in which the parent varieties showed little or no overlapping. The correlation coefficients of all the combinations were calculated, and it was found that, out of 55 possible combinations, 20 exhibited significant correlations. There was not a single case in which the correlation between two characters was closer than 0.5, a fact which in itself offers an explanation of the difficulty of recognizing types in maize.

This lack of coherence of characters in maize, coupled with the fact that in order to maintain a satisfactory degree of vigour diversified ancestry must be maintained seems to render the method of isolating types inapplicable to this plant. As an offset to the limitation thus imposed, advantage may be taken of the facility with which desirable characters derived from different parents can be combined.

Appended is a bibliography of 11 works.

1070 – **Number of Chromosomes and Size of the Nucleus in Some Forms of *Antirrhinum*.** — BRESLAVETZ. L., in *Труды Бюро по прикладной Ботаникъ* (*Bulletin of Applied Botany*), 9th year, No. 6 (91), pp. 281-287 (English text pp. 288-293). Petrograd, June, 1916.

As cytologists rarely have at their disposal pure material of non-hybrid origin, and as much importance is attributed to the nucleus and chromosomes in the transmission of hereditary characters, the number of chromosomes in pure lines of certain plants and in their hybrids have been determined.

The researches were carried out with pure lines of *Antirrhinum majus*, *A. latifolium* and *A. tortuosum*, and also with hybrids of the first and second, and the first and third. The cells used were taken from the flower buds, 280, 84, 56, 19, 25 being examined from each variety in the order cited. Thanks to the abundance of material it was possible to obtain a large number of nuclei in which the nuclear plate was clearly visible. The nucleus and chromsomes are very small, but during the phase of the nuclear plate the chromosomes are far enough apart to be counted easily.

Also, the size of the nucleus has been determined during the phase of "synapsis" when the nuclear content gathers itself together at one side. The researches of other workers have shown that the difference in the size of the nuclei of different plants is most evident in the sexual cells during this phase of synapsis, and also that the size of the nucleus may serve as a means of morphological distinction between types that are closely related systematically.

From the data obtained it is concluded that :

(1) The number of chromosomes in the somatic cells of *A. majus*, *A. latifolium* and *A. tortuosum* is the same, i. e. 18.

(2) The number of chromosomes in the hybrid *A. latifolium* × *A. majus* is also 18.

(3) The shape of the chromosomes is the same in all the plants studied.

The results of the investigations on the size of the nucleus are as follows :

| | Number of nuclei measured | Average diameter | | |
|---|---|---|---|---|
| *A. latifolium* | 120 | 7.01 μ | = | 100 |
| *A. majus* | 75 | 6.84 μ | = | 97 |
| *A. tortuosum* | 45 | 6.01 μ | = | 85 |
| *A. majus* × *A. tortuosum* | 96 | 6.04 μ | = | 86 |

These results show that :

*a*) The size of the nucleus in the pollen mother-cells at the phase of synapsis is almost the same in *A. latifolium* and *A. majus*, while the nucleus of *A. tortuosum* is considerably smaller.

*b*) The difference between the size of the nuclei in *A. tortuosum* and in *A. majus* and *A. latifolium* finds a parallel in the external morphological character of these types.

*c*) The nuclei of the hybrid *A. majus* × *A. tortuosum* are the same size as those of *A. tortuosum*.

The differences in the size of the nuclei in these varieties of Antirrhinum lead one to suspect other morphological differences may exist between the nuclei, though they escape detection for the time. It might repay investigation to examine various other plants in which the shape and number of the chromosomes are the same, but in which the dimensions of the nuclei differ.

The article is followed by a résumé (pp. 294-309) of present-day theories of the nucleus as transmitter of hereditary characters. A bibliography of 95 publications is appended.

1071 – **A Case of Variations Observed in the Potato in Holland.** — VAN LUIJK in *Cultura* 28th year, No 332, pp. 124-127. Wageningen, 1916.

A mother plant of the variety Leeuwsche blauwen known by the number 07 was isolated in 1911 for the purpose of investigations on " mosaic disease ". Among its direct descendants a perfectly healthy individual suddenly appeared in 1912, which was distinguished from the rest of the plants by the greater rigidity of its stem, its heavier weight (2.9 lbs. heavier), by the colour of its tubers, (deep violet instead of violet), and by the elongated oval shape of its tubers. This is an interesting case of variation.

The tubers from the varying individual were planted in pots, and in 1913, 95 plants were obtained which naturally grouped themselves into four divisions :

1) 76 plants susceptible to mosaic disease. Some of these resem

bled the mother plant 07 in appearance and size and others exhibited more or less variation in shape and colour.

2) 17 healthy plants with violet tubers.

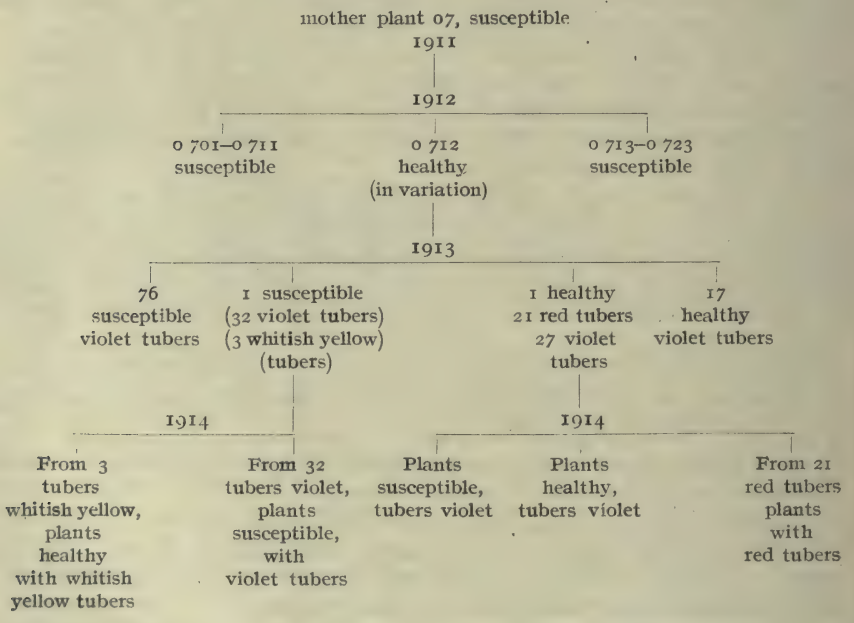
3) 1 plant possessing normal tubers, with the exception of three of a whitish yellow colour. The latter were planted, and in 1914 produced pure descendants with whitish-yellow, healthy tubers.

4) 1 almost healthy plant, showing evident marks of variation : violet petioles : glabrous and shining leaf blades, very elongated ; growth rapid and exuberant ; tubers of various shapes — normal violet and rounded, deep violet and rather oval, red and very elongated. These were all planted separately in pots, and in 1914 the crop showed that

*a*) the red colour is tramsitted by the red tubers to their descendants, which are more or less liable to " mosaic disease ".

*b*) the violet tubers produce plants bearing violet tubers, but these plants are clearly divisible into two groups — healthy and susceptible.

From these data the following genealogical tree may be built up :




This biological study is being continued with a view to establishing the character and number of the " determinant " elements in the appearance of new characters.

This case of variation is of some scientific importance and is also of much practical value, as it demonstrates the possibility of isolating and fixing a variety of potato which is healthy and not susceptible to mosaic disease.

1072 – **Experiments on Crossing Two Varieties of Sunflower (*Helianthus annuus* × *H. agrophyllus* A. Gray) to obtain a type resistant to rust, in Russia.** — SAZYPEROV, F. A., in *Труды Бюро по прикладной Ботанике*. (Bulletin of Applied Botany). Year IX, No. 5. (90) pp. 207-227; (English text pp. 228-244), 4 plates. Pétrograd, May 1916.

In the breeding of sunflowers for oil great importance is attached to their resistance to several hostile agents, of which the chief are *Homeosoma nebulella* Hb., *Orobanche cumana* Wall., and *Puccinia Helianthi* Schr. There are types of Sunflower which are resistant to the first or second enemy (for example the group of " cuirassed " (1) Sunflowers, and among them the Karzinskij, which is not attacked by *Homeosoma nebulella* Hb., and the Zelenka which, besides, resists *Orobanche cumana* Wall). but we do not yet possess an oil Sunflower capable of resisting the rust, the most redoubtable enemy of all. *Puccinia Helianthi* attacks all types, that of *H. annuus* L. as well as that of *H. debilis* Nutt ; *H. agrophyllus* A. Gray, an ornamental plant, is a solitary exception.

The experiments were carried out at the section of Voronezh of the Bureau of Applied Botany of the Ministry of Agriculture. The preliminary investigations carried out by the author on several varieties of sunflower had established the fact that *H. Agrophyllus* A. Gray, was endowed with a certain resistance to rust ; in 1912, one plant of this was not attacked by rust, and in 1913, a very wet year, a good number of plants escaped the disease. For this reason, a cross was made between (1) a variety of cuirassed Sunflower (var. Ugolnij) resistant to *Homeosoma nebulella* and to *Orobanche cumana* Wall and selected from one of the plots of sunflowers not infested by Orobanche, and (2) a *H. agrophyllus* received from Germany. The choice fell upon the latter because, unlike other seeds obtained from Italy and Moscow, it was not attacked by rust.

The mother plant was *H. annuus* and the male plant *H. agrophyllus* ; their characteristics are as follows :

| *Helianthus Annuus* L. var. *Ugolinij*. | *Helianthus Agrophyllus* A. Gray. |
|---|---|
| 1) Stem not branched | Stem much branched from the base. |
| 2) Average height of stem 165 cm (= 66 ins.). | Average height of stem, 175 cm (= 70 ins.). |
| 3) Stem covered with thick and rigid hairs. | Stem covered with soft whitish hairs. |
| 4) Upper part of the stem clothed with longer and softer hairs. | Upper part of the stem clothed with a thick down of a silvery white colour. |
| 5) Middle leaves heart-shaped. | Middle and especially upper leaves elongated, or lanceolate. |
| 6) Leaves green and wrinkled | Leaves whitish, felty on both sides, and soft |
| 7) A single large inflorescence. | Several small inflorescences the largest measures 7-8 cms (= 2.8 - 3.2 ins.) |
| 8) Receptacle flat, slightly convex. | Receptacle very convex. |
| 9) Ray florets yellow (var. *flavus*). | Ray florets dark yellow (var. *vitellinus*). |
| 10) Disc florets dark yellow (var. *vitellinus*) | Disc florets brown (var. *brunneus*). |

(1) The " cuirassed " sunflowers distinguished by a special structure of their fruit (achene) in the pericarp of which, between the corky layer and that of sclerenchyma there occurs a specially thickened layer.

| | |
|---|---|
| 11) Achenes large. | Achenes small. |
| 12) Achenes of type Zelenka (2) | Achenes of type Gajdukovskij (2). |
| 13) Achenes not spotted. | Achenes spotted. |
| 14) Flowering rather late. | Flowering very late. |
| 15) Badly attacked by rust. | Not attacked by rust. |

The individuals of the first generation were not uniform and showed several degrees of intermediate types which was to be anticipated, seeing that the mother plant was heterozygous. Nevertheless, it was the character of the male plant which predominated, especially in the structure of the leaves, and in the branching. As for the resistance to rust, it turned out that all the plants with green leaves, that is to say those which resembled the mother plant, were very strongly attacked by the parasite. The rust also attacked a small part of the plants with grey-green leaves, i. e. those intermediate in structure between the female and male parents. All the other plants, with silvery-grey leaves resembling those of the male parent, were not subject to rust. The fact that 2-3 of the individuals were resistant to rust showed that the investigator was on a good track, and although among these individuals there was not one that was interesting from the agricultural point of view the researches were followed up in 1915.

For the second generation the observations were made in 307 individuals reproduced from the seeds of plants which had not been attacked by rust. In this generation a considerable number of types were obtained in which were combined, in various proportions, the characters of one or the other ancestor. Though it was not possible to find any individual presenting a pure reproduction of the characters of its forebears, yet types were often observed that were very close to one of the ancestors and only differed from it in one or two characters. At the same time a considerable number of individuals were observed which occupied an intermediate position between the two original parents, as had already been noticed among the individuals of the first generation. Neglecting other characters of the hybrids of the second generation, their behaviour with regard to rust may be indicated. It must be remembered that the year 1915 was most exceptional for the spread of this disease. The heavy summer rains encouraged the development of the parasite so that by mid-August nearly all the leaves of the Sunflower were withered in a very large number of plants. But observations made in this year, so favourable to rust, showed that ¼ of the hybrids resisted the disease. The distribution, with reference to their structure, of the leaves which were attacked by rust and those which were resistant to it, was as follows :

(2) The achenes of the sunflower Zelenka are characterised by the presence of a cuirassed layer and by their striped coats, while in those of the sunflower Gajdukovskij there is also a special pigment soluble in water which is localised in the corky layer. See Bulletin of Applied Botany, No. 4-5 (79) pp. 574-576. Pétrograd, 1915.

| | Leaves attacked by rust | Leaves not attacked by rust |
|---|---|---|
| *a*) Green leaves. . . . . | 215 | 6 |
| *b*) Grey-green leaves . . . . . | 8 | 64 |
| *c*) Silvery-grey leaves . . . . . | 3 | 7 |
| | 226 | 77 |

It is seen from this table that the plants affected by the disease had rough green leaves, while those which were resistant had grey-green leaves of the intermediate type or silvery-grey leaves of the male type. If it be considered that only the seeds of those hybrids were used which were not attacked by rust the preceding year and which, in most cases, had grey-green leaves, and also that one is depending on the characteristics of the second generation, it must be recognised :

(1) that the resistance to rust is a recessive character.

(2) that it fully obeys the Mendelian law.

(3) that between this characteristic and the structure of the leaves there does not exist an absolute correlation, since the immune plants are found in all the classes (*a*, *b*, and *c*).

In the second generation there are types which may also have an interest from the agricultural standpoint, and which will serve for the future experiments that it is proposed to make with a view to obtaining a form of sunflower resistant to rust and useful for agriculture. Meanwhile, these initial experiments have given a result of practical importance, namely that by crossing appropriate parents a variety of Sunflower can be obtained which is resistant, at one and the same time, not only to *Homeosoma nebulella* Hb., and to *Orobanche cumana* Wall., but also to *Puccinia Helianthi* Schr.

CEREALS AND PULSE CROPS

073 – **Results of 20 Years Experiments on Maize at the Agricultural Experiment Station, Ohio.** — WILLIAM, C. G. and WELTON, F. A. in *Bulletin of the Ohio Agricultural Experiment Station*, No. 282, pp. 71-109, 9 fig. Wooster, Ohio, 1915.

1) Comparing a five year rotation system with the continuous growing of maize, the former has given an increase of 13 to 14.79 bushels per acre in spite of the heavier use of manure and fertilisers under continuous culture. The five year rotation consisted of maize, oats, wheat, clover and timothy, clover being the fourth year, and timothy, the fifth, both being sown together in the wheat. Comparing a five year with a three year rotation (maize, wheat, clover) the latter has given an increase of 6 to 8.39 bushels per acre. Comparing a three year rotation with continuous cropping, no fertilisers used in either case, the yield of corn from the former is 127 per cent greater, than in the latter, as shown in Table I. The results for the five year and three year rotations are given for an average of 20 and 17 years respectively.

2) The use of phosphorus alone, in the form of acid phosphate, has increased the yield of corn 8.28 bushels per acre. The use of manure alone has increased the yield 31.27 bushels per acre as an eight year average.

The use of acid phosphate and manure has increased the yield 40.58 bushels, thus leaving 9.31 bushels to be credited to the acid phosphate.

3) On such acid soils as are found on the Station farm at Wooster, one ton of burned lime, or two tons of ground limestone, applied once in 5 years, has increased the yield of corn on an average 7.35 bushels per acre on the fertilised plots and 8.25 bushels per acre on the unfertilised plots. Taking into consideration all the crops of the rotation, the application of lime has been worth, on the average, £ 2 18 *s* 0 *d* (0 $ 14.21) per acre per rotation, the cost of the lime being £ 1 1*s* 0*d*. ($ 5).

4) Comparing very deep ploughing (15 ins) with ordinary ploughing (7 ½ ins) and with subsoiling (carried out by running an ordinary subsoil plough in the bottom of the ordinary furrow for an extra depth of 7 ½ inches), the 5 year average gain for subsoiling has been 2.32 bushels per acre and for the deep ploughing, 0.43 bushel per acre, compared with the quantities obtained with ordinary ploughing.

5) Plantings of maize made at Wooster from May 4 to 10 have a given larger yields of shelled corn per acre than the plantings of other dates, though the moisture content and the shrinkage have been lower for the plantings made from April 24 to 29. Of the plantings of the latter dates, 78.62 lbs of ears as weighed in November have been required to equal a bushel of shelled corn in April, while of the planting of June 2 to 6, 91.95 lbs. of ears have been required. The variety of corn and all the conditions of growth except date of planting have been the same.

6) Where the distance between rows (42 ins.) and the number of plants per acre (12 446) have been the same, one plant every twelve inches has outyielded 3 plants every 36 inches (in hills) by 4.55 bushels per acre. The produce obtained from isolated plants and from those grouped in hills of 2,3 and 4 respectively was: — grain, 46.88 ; 46.28 ; 42.33 ; 42.85 bushels per acre ; stems (stover), 2 827 ; 2 417 ; 2 168 ; 2 180 lbs. per acre.

7) With hills 42 inches apart each way, the maximum yield of shelled corn, as a 10 year average, has been secured from 4 plants per hill or 14.220 plants per acre.

8) Nine years tests of deep (4 ins.) as compared with shallow (1 ½ in). cultivation show an average gain of 4 bushels per acre in favour of shallow cultivation. The average crops have been respectively : — grain — 56.4 ; 60.4 bushels per acre ; stems — 2 691, 2 874 lbs. per acre.

9) Two years' tests of three late cultivations of corn (in July and August) with a one-horse cultivator, after the ordinary cultivation had been carried out with a two-horse implement (five cultivations in June and early July) show an average gain of 3.44 bushels per acre for late cultivation.

10) A 10 year average variation of 6.25 bushels per acre has been found in varieties of corn well acclimatized to the locality where tested. A variation in yield of 34.29 bushels per acre has been found in varieties grown and sold for seed within the state of Ohio.

11) A comparison of ears varying 2.44 inches in length, on the average shows a difference in yield of only 1.39 bushels per acre, as a 10

TABLE I. — *Continuous vs. Rotation Corn. Twenty Years Work.*

| System | Treatment | Applied per acre | | Av. yield per acre-bushels | | | | Average yield for 20 years |
|---|---|---|---|---|---|---|---|---|
| | | Per crop | Per 5-years | 1st period | 2nd period | 3rd period | 4th period | |
| Continuous . . . | None . . . . | — | — | 26.26 | 16.76 | 10.43 | 8.44 | 15.47 |
| Rotation (1) . . | None . . . . | — | — | 31.89 | 30.82 | 131.04 | 20.31 | 28.95 |
| Continuous . . . | Manure . . . | 5 tons | 25 tons | 43.13 | 40.11 | 34.62 | 30.22 | 37.02 |
| Rotation (1) . . | Manure . . . | 8 tons | 16 tons | 40.73 | 49.52 | 59,75 | 55.83 | 51.81 |
| Continuous . . . | Commercial fertiliser . . | 250 lbs | 1 250 lbs | 38.86 | 39.09 | 28.00 | 26.83 | 33.19 |
| Rotation (1) . . | | 320 ibs | 985 lbs | 35.78 | 49.54 | 53.91 | 44.10 | 46.49 |
| Rotation (2) . . | Manure . . . | 8 tons once in 3 years on corn | | | | | | (3) 60.20 |
| Rotation (2) . . | None . . . . | Average of 8 unfertilized plots | | | | | | (3) 35.19 |

(1) 5-years rotation. — (2) 3-years rotation. — (3) Average for 17 years.

TABLE II. — *The Value of Manure and Phosphorus. Three-year Rotation.*

| Treatment | I,bs per acre | Cost | Average yield of corn per acre-Bushels | | Average value of increase per acre of all crop of the rotation | |
|---|---|---|---|---|---|---|
| | | | Period 1st 1897-1905 | Period 2nd 1906-1913 | Period 1st | Period 2nd |
| | | s. d. | | | s. d. | s. d. |
| Stall manure. . . . . | 16,000 | — | 57.13 | 64.14 | 95 7 | 121 8 |
| Stall manure . . . . . | 16,000 | 9 4 | 62.28 | 73.45 | 157 0 | 189 6 |
| Acid phosphate . . . . . | 320 | | | | | |
| Stall manure . . . . . | 16,000 | 6 8 | 61.97 | 72.05 | 148 0 | 155 11 |
| Floats . . . . . | 320 | | | | | |
| None : | | | | | | |
| Average 8 unfert. plots. . . . | — | — | 36.99 | 32.87 | — | — |

year average — a difference no greater than might have been expected had the seed used been identical — while there is a slight decrease in length of ear in the shorteared strain, it has not materially affected the yield.

12) As a 9-year average, tapering ears have excelled cylindrical ears in yield by 1,65 bushels per acre.

13) Eight years continuous selection for bare, as compared with filled tips shows an average difference of 0.34 bushel per acre in favour of filled tips.

14) Comparing rough with smooth-dented ears (in variety " Clarage ") the 7-year average yield favours the smooth type by a gain of 1.76

TABLE III. — *The Effect of Lime on Corn, Grown on Acid Soils, and the Value of Lime to the Entire Rotation. Average of 12 years.*

| Treatment (Fertilizers per acre for one rotation of 5 years) | Yield of corn per acre-Bushels | | Value per acre of all crop of the rotation | | | |
|---|---|---|---|---|---|---|
| | Unlimed | Limed | Unlimed | | Limed | |
| | | | s. | d. | s. | d. |
| I. Without nitrogen. | | | | | | |
| Phosphorus, 20 lbs in acid phosphate . . | 36.13 | 43.64 | 282 | 6 | 340 | 10 |
| Phosphorus, 20 lbs; potassium, 108 lbs, in muriate of potash . . . . . | 43.86 | 51.68 | 317 | 10 | 384 | 8 |
| II. Nitrogen, 38 lbs, with phosphorus, 30 lbs, and potassium 108 lbs. | | | | | | |
| Nitrogen in nitrate of soda. . . . . | 48.85 | 56.29 | 365 | 8 | 435 | 4 |
| Nitrogen in sulphate of ammonia . . . . | 45.80 | 57.68 | 333 | 6 | 433 | 11 |
| III. Nitrogen, 76 lbs in nitrate of soda, with phosphorus, 20 lbs, and potassium, 108 lbs. | | | | | | |
| Phosphorus in acid phosphate . . . . . | 49.06 | 55.73 | 390 | 11 | 429 | 10 |
| Phosphorus in bone meal . . . . . | 45.53 | 52.59 | 365 | 0 | 420 | 5 |
| Phosphorus in basic slag . . . . . | 48.71 | 52.07 | 384 | 10 | 402 | 5 |
| IV. Yard manure, 16 tons, estimated to carry nitrogen, 144 lbs. | | | | | | |
| Phosphorus, 48 lbs; and potassium 112 lbs. | 56.02 | 62.71 | 412 | 10 | 479 | 4 |
| Average of unfertilized plots . . . . . | 25.96 | 34.21 | 205 | 10 | 255 | 10 |

TABLE IV. — *Influence of the Time of Sowing on the Yield, Moisture Content and Loss of Weight.*

| | Date of sowing | | | | |
|---|---|---|---|---|---|
| | April 24-29 | May 4-10 | May 14-17 | May 25-28 | June 2-6 |
| Yield per acre, (average of 6 years), in bushels . . . . . | 63.86 | 68.49 | 67.07 | 54.87 | 44.32 |
| Moisture content, (average of 6 years) . . . . . | 23.73 % | 25.08 % | 25.93 % | 29.13 % | 33.52 % |
| Weight of grain obtained in April from 50 lbs ears as weighed in November, in lbs. (average of 5 years). . . . . | 35.60 | 34.55 | 33.90 | 31.65 | 30.45 |

bushels per acre. There is thus no foundation for the opinion, so widespread among growers, that lack of marked roughness is an indication of shortening of the kernels, reduced yield and deterioration in general.

15) Seed ears averaging 88.16 per cent grain have given a 6-year average yield of 64.64 bushels of shelled corn per acre, as compared with a yield of 65.06 bushels from ears averaging 76.38 per cent of grain.

16) A comparison of kernels from the butt, middle and tip portions of ears shows only 0.57 of a bushel difference in yield, as a 9-year average, and no difference in maturity or any important character.

17) Seed ears having 14,16 and 18 rows of kernels have been compared for 5 years. The 14-rowed ears led slightly in yield at Wooster and Germantown; the 16-rowed ears at Carpenter.

18) While the height of plant and ear varies with the season, selecting for high and low ears within a variety has resulted in changing very materially the relative height of ear and also the time of maturity. Low ears are associated with earliness. The comparative yield has not been reduced by selection for low ears.

19) Seed corn grown on rich, as compared with poor soil, and one plant per hill, as compared with five, though larger and apparently of better quality, has not given any larger yield, on the average, than the smaller ears grown under the poorer conditions.

20) The principal causes of barren plants are variations in season, in fertility, and in time and rate of planting. Such variations in conditions of growth have increased the amount of barrenness 200 to 2 000 per cent.

21) The cultivation in separate rows of grains from the same ear ("ear-row" tests) and the subsequent crossing of the best ears in isolated breeding plots show possibilities of increasing the yield of corn 5 to 10 bushels per acre, but it seems difficult to go much beyond this amount.

22) Of 13 first-generation crosses grown beside both parents, only two exceeded in yield the better parent variety by more than 2 bushels per acre.

23) A 4-year average gain of 3,9 bushels of shelled corn per acre has resulted from the use of the individual ear germination test. At 2*s* 1*d* (50 cents) per bushel for corn, this is a return of £ 1 7*s* 0*d* ($6.50) per hour for testing.

24) Experiments in thinning corn show a 4-year average gain of 8.47 bushels per acre in the case of untested seed and 6.31 bushels for tested seed. The average time required for thinning an acre of corn has been 5.7 hours.

25) As an average of 6 years' tests corn reached its maximum shrinkage August 1st. Based on shrinkage alone 2*s* 7¼ *d* (62.47 cents) for 70 pounds of ear-corn on August 1st is equivalent to 2*s* 1*d* (50 cents) on November 1st. While midseason and late varieties had 24.29 and 31.04 per cent of moisture, respectively, on November 1st, on August 1st they carried 10.08 and 10.69 respectively.

1074 – **Effect of Sulphur in the Cultivation of the Potato; Experiments in Chili.** — OPAZO G. R. in *El Agricultor*, No. 109, pp. 129-130. Santiago de Chili, June, 1916. STARCH CROPS

It has been shown that it is not enough to add sulphur to any or every soil to obtain good results. As proof may be cited the opinion expressed by Boullanger in his communication of July 1912 to the Paris Academy of

Science: "Sulphur stimulates the active propagation and the reducing action of bacteria, which break up the complex nitrogenous compounds into ammonia. It also acts on nitrifying organisms". From this it is concluded nitrogenous matter must first be present in the soil.

Experiments made in 1914 at the farm Valparaiso en Nuñoa were carried out under the following conditions. Rows 54 feet long and 32 inches apart were marked out on soil rich in organic matter; the seed, bought at San Carlo, was disinfected with formalin, as it was of inferior quality. The experimental field, divided into 4 plots, each 51 square poles in area, gave the following results.

| Number of plot | Treatment | Crop of tubers par acre |
|---|---|---|
| | Per plot | bushels |
| 1. (Control) | — | 236 |
| 2. | Sheep's manure, well decomposed, 1129 lbs. | 245 |
| 3. | Sheep's manure, 1129 lbs.<br>Sulphur 70.5 lbs | 381 |
| 4. | Sulphur, 70.5 lbs. | 408 |

The application of sulphur alone increased the crop of tubers by 72 per cent the action of the sheep's manure being negligible, as the soil was rich in organic manure. The experiment was repeated the following year on a field which had carried lucerne for several years, so that it was sufficiently supplied with organic matter. Corahila potatoes were planted and sulphur was applied at the rate of 4 ½ lbs. per row of 54 feet. The experiment aimed at studying simultaneously the action of sulphur and of chalk, but only the results from the plots with and without sulphur are cited, as follows:

| Area of plots | Square poles | Crop of tubers. bushels. |
|---|---|---|
| | — | — |
| Plots *with* sulphur | 701 | 1468 |
| Plots *without* sulphur | 345 | 441 |

In this experiment the crop of tubers was increased by 65 per cent by the action of sulphur.

Conclusion. The author advises the use of sulphur on soils rich in nitrogenous matters or in countries where the requisite quantities of sheep or cow manure can be obtained.

The sulphur can be selected at the lowest price, as it is not necessary for it to be sublimed. In Germany iron pyrites containing the proper quantity of sulphur has been used, and the same results obtained as with the application of purified or sublimed sulphur.

1075 – **Experiments on the Cultivation of Meadows on Peat Soils in Russia.** — Fominykh V. A., in *Сельское Хозяйство и Лѣсоводство* (Agriculture and Sylviculture), Vol. CCLI, Year LXXVI, Pétrograd, June 1916.

The experiments were carried out in 1914 and 1915 in the province of Toula according to the following plan :

1) Harrowing with harrow of different types.

2) Harrowing and manuring.

4) Deep ploughing manuring and seeding with grass seeds after the removal of a preparatory crop.

5) Deep ploughing, manuring, chalking and seeding with grass seeds after the removal of preparatory crop. Nearly all the experiments were repeated on three plots of 72 sq. poles each. The manures applied were 2.9 cwt. basic slag per acre and 66 lbs of potash salts per acre. For chalking, each acre received 9 cwt. of chalk. With regard to the seeding, each acre received 11 lbs. per acre of the following : species *Trifolium pratense* L., *T. hybridum, T. rèpens, Phleum pratense* L., *Festuca pratensis* Huds., *Poa pratensis* L., *Poa trivialis* L., *Cynosurus cristatus* L., *Bromus inermis* Leyss. and *Lolium perenne* : in some cases *Agrostis vulgaris* Wish. and *Dactylis glomerata* L. were added. The first year, for various reasons, the experiments were not successful, especially with a preparatory crop. The results of the second year's experiments are summed up in the following Table.

*Experiments on the Cultivation of Peat Bogs.*

| | Average percentage increase over the same area (5.46 sq. yds.) | | | Percentage composition of species | | | |
|---|---|---|---|---|---|---|---|
| | | | | On the field | | In hay | |
| | In the number of plants | In the height of plants | In the bulk of the vegetation in the green state | Species of little use or useless | Useful species | Species of little use or useless | Useful species |
| | per cent | per cent | per cent | per cent | per cent | per cent | per cent |
| Control . . . . . | — | — | — | 93.2 | 6.8 | 97.0 | 3.0 |
| Harrowed . . . . . | 32 | 34 | 56.8 | 86.1 | 13.9 | 89.3 | 10.7 |
| Harrowed and manured . . . . . | 113 | 66 | 290.4 | 62.0 | 38.0 | 74.6 | 25.4 |
| Harrowed, manured and seeded . . . . | 234 | 88 | 347.0 | 37.6 | 62.4 | 37.0 | 63.0 |
| Harrowed, manured chalked and seeded | 230 | 101 | 438.0 | 45.0 | 65.0 | 29.3 | 60.7 |
| Ploughed deeply, manured and seeded. . | 232 | 108 | 637.7 | 28.0 | 72.0 | 20.5 | 79.5 |
| Ploughed deeply, manured, chalked and seeded . . . . . | 242 | 121 | 650.4 | 26.0 | 74.0 | 15.5 | 84.5 |

From the results obtained the following conclusions are drawn :

1) By a simple harrowing the crop of forage is increased on the average by 56.8 per cent.

2) Harrowing and manuring give an increase of nearly 300 per cent.

3) Harrowing, manuring and seeding give an increase of 350 per cent on the crop, causing at the same time a considerable modification in the flora of the cultivated peat bogs.

4) Complete cultivation, with deep ploughing, manuring and seeding gave an increase in crop of 600 to 900 per cent.

5) Experiments with weeded areas gave results of little promise, though not absolutely discouraging.

6) The increase of crop which follows the cultivation of peat bogs is determined by the following factors :

*a*) Increase in the nutritive capacity of the soil, which results in an increase in the number of plants per unit area and also in better development of the individual plants.

*b*) The light and worthless species disappear from the hay and are replaced by more valuable grasses and leguminous plants which are heavier and more tufted.

7) The importance of the cultivation of peat bogs is therefore not only quantitative but also qualitative, because with improved cultural methods the poor and useless species of the flora disappear very rapidly from the bogs and are replaced by useful species which, with favourable soil conditions, show good development of aerial parts as well as of underground parts.

With regard to the economic side of the experiment, the expenses incurred in the cultivation of peaty meadow were completely repaid during the second year, cost of drainage etc. being taken into consideration.

1076 – **Chemical Composition of Alfalfa as Affected by Stage of Maturity, Mechanical Losses and Condition of Drying.** — SWANSON, C. O., and LATSHAW, W. L. (Chemical Department, Agricultural Experiment Station, Manhattan, Kansas), in *The Journal of Industrial and Engineering Chemistry*, Vol. 8, No. 8, pp. 726-729. Easton, Pa., August, 1916.

Experiments on the chemical composition of lucerne (alfalfa) have been carried out for two years running, 1914, with a moderately dry summer and 1915, with an unusually wet season. The lucerne to be analysed was cut from duplicate and triplicate 0.1 acre plots, at the time of budding, one-tenth bloom, full bloom and at seed formation. As soon as cut, a sample was taken and spread in an attic room to dry. When the hay cut in the field was dry enough to stack it also was sampled, and the sample was taken to the same attic room. When the green sample was partially wilted a subsample was taken, and the proportion of leaves to stem was determined on an air-dry basis. Samples of alfalfa cut at the same stages of maturity were also obtained at the time of feeding.

The analytical figures show that lucerne cut at the time of budding contains a maximum proportion of ash and crude protein, together with a minimum of crude fibre and nitrogen-free extract. The latter increase

*Pounds of nutrients produced per acre in the total crop, leaves and stems.*
*Calculated on a 10 % moisture basis.*

| | Stage of maturity | Ash | Crude protein | Pure protein % of crude protein | | Crude fibre | N-free extract | Ether extract |
|---|---|---|---|---|---|---|---|---|
| | | | | in sum | in shade | | | |
| | *1914* | lbs | lbs | per cent | per cent | lbs | lbs | lbs |
| Whole crop | Bud | 817.01 | 1 483.66 | 86.09 | 71.96 | 1 815.57 | 2 674.92 | 186.75 |
| | 1/10 bloom | 664.35 | 1 235.92 | 83.50 | 74.55 | 1 734.61 | 2 399.51 | 251.00 |
| | Full bloom | 534.61 | 967.17 | 86.04 | 80.55 | 1 589.52 | 2 167.56 | 218.50 |
| | Seed | 331.40 | 674.55 | 84.95 | 84.00 | 1 310.24 | 1 786.94 | 134.82 |
| Leaves | Bud | 487.06 | 1 145.44 | 75.79 | | 582.41 | 1 501.87 | 147.07 |
| | 1/10 bloom | 405.43 | 946.55 | 78.21 | | 556.12 | 1 422.32 | 167.22 |
| | Full bloom | 281.07 | 693.07 | 80.98 | | 429.39 | 1 258.41 | 159.95 |
| | Seed | 182.21 | 423.12 | 82.88 | | 286.00 | 804.76 | 93.93 |
| Stems | Bud | 329.95 | 338.22 | 68.62 | | 1 233.16 | 1 173.05 | 39.68 |
| | 1/10 bloom | 258.92 | 289.37 | 73.08 | | 1 178.49 | 977.19 | 83.78 |
| | Full bloom | 253.54 | 274.10 | 74.24 | | 1 160.13 | 909.15 | 58.55 |
| | Seed | 149.19 | 251.43 | 79.64 | | 1 024.24 | 982.18 | 40.89 |
| | *1915* | | | | | | | |
| Whole crop | Bud | 878.31 | 1 710.30 | 75.92 | 64.41 | 2 303.80 | 2 683.76 | 143.25 |
| | 1/10 bloom | 1 066.34 | 1 767.20 | 74.22 | 66.65 | 3 376.50 | 3 516.62 | 199.52 |
| | Full bloom | 1 165.08 | 2 088.10 | 75.78 | 70.79 | 4 109.71 | 4 338.46 | 269.99 |
| | Seed | 792.31 | 1 419.88 | 75.55 | 75.67 | 3 094.71 | 3 329.07 | 189.25 |
| Leaves | Bud | 436.63 | 1 121.35 | 72.30 | | 639.95 | 1 391.65 | 107.21 |
| | 1/10 bloom | 484.55 | 1 120.28 | 74.17 | | 821.54 | 1 522.86 | 149.80 |
| | Full bloom | 501.25 | 1 136.69 | 75.20 | | 796.69 | 1 891.82 | 180.29 |
| | Seed | 340.40 | 796.66 | 77.16 | | 619.83 | 1 359.82 | 111.55 |
| Stems | Bud | 441.68 | 588.95 | 56.86 | | 1 663.85 | 1 292.11 | 36.04 |
| | 1/10 bloom | 521.79 | 646.92 | 58.05 | | 2 554.96 | 1 993.76 | 49.72 |
| | Full bloom | 663.83 | 951.41 | 63.13 | | 3 313.02 | 2 546.64 | 89.70 |
| | Seed | 451.91 | 623.22 | 75.07 | | 2 474.88 | 1 969.25 | 77.70 |

as the maturation of the plant progresses, while the ash and crude protein decrease. The total amount of any or all nutrients produced per acre depends to a large extent on the yield, as was shown by the fact that in 1914 the greatest amount of nutrients was obtained in the bud stage, while in 1915 the full bloom gave the greatest amount. The leaves and stems differ in content of ash, ether and nitrogen free extract, but the greatest difference is in the per cent of crude protein and crude fibre. The leaves contain, over 2 ½ times as much protein as the stems, while the stems contain over 2 ½ times as much crude fibre as the leaves. As in harvesting and handling lucerne there is a large loss of leaves, the hay comes to be richer in crude fibre and poorer in crude protein.

The alfalfa cured in the sun has a larger pure protein content, as determined by STUTZE'S method, than that cured in the shade. This difference is so great as to more than offset the influence of the loss of leaves, and it was also most pronounced in the alfalfa cut in the earlier stages.

The adjoined Table sums up the principal results of the experiments.

To sum up, the feeding value of hay is affected not only by mechanical losses due to handling, and the changes due to bacterial action, but also by chemical changes which have hitherto been little noticed or understood.

1077 – **Studies of the Timothy Plant.** — WATERS, H. J. in *University of Missouri, College of Agriculture, Agricultural Experiment Station, Research Bulletin*, 10, pp. 1-68, 37 fig. + 19 tables. Columbia, Missouri, June 1915.

Experiments have been conducted to determine the influence of the stage of maturity of timothy upon the yield, composition, digestibility and the nutritive value of the hay and also upon its palatability to animals. The investigations were begun in 1896 and continued with more or less interruption till 1909. The cutting of the timothy was done at different stages of maturity ; 1) about June 12th, when the plants were just in full head ; 2) about June 20th, when the plants were in full bloom ; 3) about July 1st, when the seed had formed; 4) about July 8th, when the seed was in dough ; 5) about July 16th, when the seed was ripe but not fallen. Harvesting and analysis were carried out in the usual way. In the first digestion trial two-year old high grade Shorthorn steers were used, and in the others, yearling grade Shorthorn steers. Tests of palatability were made with yearling beef steers fed on hay alone ; with Jersey cows in milk, fed with silage, corn, stover and mixed grain, in addition to the hay under test; and with yearling sheep fed only with mixed grain and the hay under test.

The following results were obtained :

*The yield of cured hay.* In two years, the yields of hay were greatest from the fourth cutting, when the seed was in the dough stage ; in two years, the yields were greatest from the third cutting when the seeds were beginning to form ; and in one year, from the fifth cutting, when the plants were fully ripe. The average result of all the trials shows the largest yield from the third cutting, when seeds were beginning to form.

If the yield from the third cutting were expressed as 100, the yields from the other cuttings would be 99.3 for the fourth cutting, 93.8 for the second, 89.7 for the fifth and 89.4 for the first. Thus, the difference

between the third and fourth cuttings was slight, averaging but 43 lbs of hay per acre. The difference between the yield of the first and last cuttings was small, but these cuttings produced an average of between 500 and 600 pounds less hay to the acre than did the third and fourth cuttings. Thus these intermediate periods, when the seeds have been formed, show the maximum yields of cured hay.

*The yield of digestible nutrients.* The yield of digestible nutrients is a much more accurate measure of the value of the harvest than the quantity of cured hay obtained. When measured by the standard of digestible nutrients produced, the earlier cuttings make a more favourable showing than when measured by the amount of cured hay produced. This is because the animals digest the early-cut hay more completely than they do the late-cut hay. The digestibility of timothy hay declines steadily as the plant develops, beginning as early as when the plants are in full head. The second cutting, when the plants were in full bloom, gave the largest yield of digestible dry matter, digestible protein, digestible fat, digestible crude fibre and digestible nitrogen-free extract of any of the five cuttings. In Table I are summed up the coefficients of digestibility of the different cuttings, given as the mean of all the trials.

TABLE I. — *Summary of average digestion coefficients of all trials.*

| Cutting | Digestion coefficient | | | | | |
|---|---|---|---|---|---|---|
| | Total dry matter | Protein | Ether extract | Crude fibre | Ash | Nitrogen-free extract |
| | per cent | per cent | per cent | per cent | per cent | per cent |
| First | 58.51 | 51.61 | 38.12 | 65.78 | 34.76 | 55.02 |
| Second | 54.88 | 50.09 | 35.62 | 58.73 | 32.01 | 55.42 |
| Third | 49.86 | 41.63 | 45.87 | 51.49 | 29.32 | 52.45 |
| Fourth | 47.39 | 38.78 | 48.85 | 48.98 | 31.76 | 48.97 |
| Fifth | 47.37 | 42.05 | 43.06 | 50.87 | 28.45 | 47.56 |

Table II sums up, for each of the five cuttings and as a mean of all the experiments, the absolute and relative yield of digestible substances ; in this case the relative figures are expressed in terms of the greatest amount of each substance, reckoning this maximum as 100.

*Palatability of hay as affected by the time of harvest.* — Yearling steers fed entirely on timothy hay, when given free access to the hays from all the cuttings, in every case showed preference for them in the order in which they were cut. The fourth and fifth cuttings were left almost untouched until the hays of all earlier cuttings had been entirely eaten. Milking cows, having grain and other roughage besides the hays under test, were not so discriminating in their taste as regards the first three cuttings, but they, like the steers, left the fourth and fifth cuttings almost untouched until

TABLE II. — *Average yields of digestible nutrients per acre.*

| Cutting | Dry Matter | | Crude protein | | Ether extract | | Crude fibre | | Ash | | Nitrogen-free extract | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Actual | Relative | Actual | Relative | Actual | Relative | Actual | Relative | Actual | Relative | Actual | Relative |
| | lbs | % | lbs | % | lbs | % | lbs | % | lbs | % | lbs | % |
| 1 | 1 995,7 | 91.7 | 134.7 | 91.9 | 42.8 | 79.1 | 777.0 | 98.9 | 77.1 | 93.4 | 899.3 | 83.1 |
| 2 | 2 175.3 | 100.0 | 146.5 | 100.0 | 43.8 | 80.9 | 785.7 | 100.0 | 82.5 | 100.0 | 1 082.1 | 100.0 |
| 3 | 2 038.8 | 93.7 | 113.3 | 77.3 | 50.9 | 94.1 | 761.7 | 96.9 | 69.8 | 84.6 | 1 040.6 | 96.1 |
| 4 | 1 913.7 | 87.9 | 98.0 | 66.9 | 54.1 | 100.0 | 699.9 | 89.1 | 67.4 | 81.7 | 995.5 | 92.0 |
| 5 | 1 774.8 | 81.6 | 91.9 | 62.7 | 37.5 | 69.4 | 683.1 | 86.9 | 63.0 | 76.3 | 892.6 | 82.5 |

the first, second and third cuttings were eaten. Sheep, full fed on mixed grain, appeared to eat one cutting with as much relish as another.

*The permanence of the stand.* — The results show conclusively that the time of cutting affects the length of life of a meadow. Early cutting tends to weaken the stand and late cutting to conserve the strength of the plant and prolong its life.

1078 – **The Artichoke as a Forage Plant.** — VASQUEZ A. in *Revista de la Cámara Agrícola Balear*, 18th year, No. 15, pp. 113-119. Palma de Mallorca, Aug. 10th 1916.

A good summer forage plant for dry countries must be deep rooted, and must use little water during the summer. Both these conditions are fulfilled by the cardoon (*Cynara Cardunculus*) and the artichoke (*Cynara Cardunculus* var. *Scolymus*). Given a favourable season, if these plants are sown in autumn their roots will reach a depth of 3 feet in less than 10 months and 4 feet in 20 months. Besides this, if the plant is cut in spring it develops few or no leaves during the summer, so that the amount of water lost by transpiration is much reduced ; the roots, however, continue to grow and strike down into deeper strata of the subsoil, and when the great heat is over they supply the plant with the subsoil, thus enabling new shoots to be formed.

The value of these forage plants has been proved by experiments carried on for several years in the province of Toledo, in Spain, by *Celedonio Rodrigañez.*

Various species of artichokes have been tested and the best results have been obtained with variety well known in Andalusia and the neighbouring provinces under the name of " arcaucil " or " alcaucil ", and on the market as " alcachofa verda de Provenza ". Among the cardoons the " cardo de España " was the most successful. Naturally species with many spines are to be avoided.

The cardoon is propagated by seed, the artichoke by cuttings, but if the latter cannot be watered they root with great difficulty. In this case seeds must be sown and the seedlings pricked out in 6 or 8 weeks into well worked soil ; the rows should be 32 inches apart, and the plants 32

inches apart in the rows, arranged on the square. Autumn is the best time for sowing, but it can also be done in the spring. The quantity of seed needed is 1 $^3/_4$ to 2 $^3/_4$ lbs per acre, and it should be soaked in water for 24 hours before sowing.

The necessary cultivation consists of four weedings per annum : in spring, May or June, August and winter.

One or two cuttings are made in spring and one in autumn, the first being made when the plants reach the age of 18 months. The first spring cutting may produce as much as 48 tons of green forage per acre. The second spring crop yields up to 8 tons per acre, and the autumn crop to 30 tons per acre.

To obtain the maximum of forage the crop should be mown just when it begins to come into flower, but as this procedure weakens the plant it is better to cut a little earlier, level with the ground, care being taken not to injure the collar of the plant. One labourer will cut and tie about one acre in a day.

The artichoke is not suitable for ensilage, but it makes good hay. The forage is readily eaten by cows and bullocks, horses, mules, pigs and goats. Milking cows fed exclusively with this forage do not show any change in their conditions nor in the milk that they produce.

The introduction of this forage plant into Majorca is recommended.

1079 – **Analysis of Cotton at the Chief Stages of its Development** (Publications of the Experiment Station of the " Golodnaia Steppe ", Samarkand district). — ROGALSKIJ B. V. in *Журналъ Опытной Агрономіи* (Review of Agricultural Experiments), Vol. XVII., Book I, pp. 13-36. Petrograd 1916. FIBRE CROPS

In order to obtain preliminary data for a more exhaustive study, experiments have been carried out on the variety " King " which belongs to the Upland group (*Gossypium hirsutum* L.) and which seems to be well suited to the region of the Golodnaia Steppe (1) a part of the Russian possessions in Central Asia. The year 1913 was meteorologically favourable to cotton, and no damage was done by the harmful salts, especially chlorides and sulphates, which are present in remarkable quantities in the soil of this region. The cotton was cultivated on irrigated soil, which was clayey in texture, and not too impregnated with salts.

(1) The " Golodnaia Steppe " is a vast, slightly undulating plain, with a hardy perceptible slope ; it is traversed by the railway and, according to approximate calculations, it possesses about 200 000 acres perfectly suitable for irrigation and the cultivation of cotton. See " Culture of Cotton in Russia " by KNIZE A. I., in « Ежегодникъ Главнаго Управленія Землеустройства и Земледѣлія по Департаменту Земледѣлія и Лѣсному Департаменту за 1907 годъ » (Annual Report of the Department of Agriculture and Forestry) S. Petersbourg, 1908, pp. 315-361. A description of the climatic conditions, soil and vegetation of the Golodnaia Steppe is given in the Compte Rendu of the Experimental Farm of the same name, for 1906, published by the Director, BUCHAEV, M. M., in « Труды Хлопковаго Комитета, томъ I ». (Publications of the Cotton Committee), edited by the Department of Agriculture, St. Petersbourg, 1907, pp. 71-150. (*Ed.*)

The vegetative period of the plant extended over 174 days, the seeds being sown on May 7th. Analyses were made at four different times :

1) When the flower buds first appeared (June 7th).

2) At the beginning of flowering (September 22nd).

3) At the first picking (September 29th).

4) After the death of the plants, which was caused by the morning frosts (October 28th) .

The first two analyses were made on the whole plant ; in the last two the following parts were analysed separately : hairs (lint), seed minus its coats, seed coat, unripe capsules, fruit coats, stems and leaves.

The maximum growth of the plants is reached at the time of the first picking the average weight of a single plant being 196.67 gm. when green, and 82.10 when absolutely dry. When the plant dies the weight decreases on account of dessication and the loss of parts of the plant, the average green weight then being 116.93 and the dry weight 54.69.

The percentage of water in the green weight gives an unexpected result in comparison with other plants; this percentage is greater at the beginning of flowering than when the flower buds appeared (80.89 agains 73.81) ; in the two later periods it was 58.25 and 52.23 respectively. A possible explanation of this lies in the fact that in the early stages of development cotton is sensitive to the harmful action of the salts in the soil. Yet another explanation may be that during the flowering period the plant needs much water to promote an active circulation of food materials.

The appended table sums up the analytical results. This table, together with others, which are given in the text of the paper, show that the chief modifications occurring in the cotton plant during the various stages of its development are as follows :

1) As time goes on, there is of reduction in the relative amounts of nitrogen, nitrogen-free extracts and ash ; the maximum amounts of ash and N - free extract occur in the green parts of the plant.

2) The percentage composition of the ash shows that cotton demands potash more than anything else, then lime, and finally phosphorus. The ash also contains large amounts of chlorides and sulphates, the substances which work the greatest harm to the agriculture of the district. The plant fights against this harmful action by developing its vegetative organs rapidly.

3) As the plant develops there is an accumulation of raw cellulose and pentosans, which form the cell walls.

4) The analysis of the cotton itself, by the methods adopted by I. Konig, Gross and Bevan justifies the hypothesis that it is not pure cellulose, but a mixture of cellulose and hemi-cellulose. For cotton of the first quality, the composition is 71.190 per cent cellulose ($\alpha$ cellulose) and 21.355 per cent ($\beta$ cellulose).

5) The green parts of the plant and the seeds contain a high percentage of fats, and the greater part of the percentage in the whole plant occurs in these parts.

Taking the ash analysis as a basis, and reckoning 21 680 plants to the

*Chief constituents of cotton, variety King, grown in 1913 on the « Golodnaia Steppe ».*

| No. of sample | Description of sample | In 100 parts | | Percentage composition of dry matter | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | of the green substance of the plant | of the dry matter of the plant | Nitrogenous compounds | Raw cellulose | N-free extract | Starch | Pentosans | Raw fats | Ash | Total of estimated substances | Total of unestimated substances |
| | | | | per cent | per cent | per cent | per cent | per cent | per cent | per cent | per cent | per cent |
| 36 | *At time of appearance of flower buds* | — | — | 19.224 | 12.908 | 23.236 | 0.599 | 9.454 | 4.652 | 23.656 | 93.729 | 6.271 |
| 91 | *At beginning of flowering* | | | | | | | | | | | |
| | Plants with flowers | — | — | 17.466 | 21.543 | 18.019 | 0.816 | 9.289 | 2.664 | 12.494 | 82.291 | 17.709 |
| | Plants without flowers | — | — | 17.225 | 22.089 | 19.193 | 0.567 | 9.020 | 2.578 | 12.441 | 83.113 | 16.887 |
| | *First picking* | | | | | | | | | | | |
| 208 | Lint | 3.291 | 6.909 | 1.683 | 91.484 | 1.191 | 0.084 | 1.644 | 1.523 | 2.352 | 99.961 | 0.039 |
| 208 | Seed without coat | 6.915 | 8.213 | 23.762 | 4.325 | 8.582 | 0.482 | 3.884 | 48.988 | 3.454 | 93.477 | 6.523 |
| 208 | Seed coat | | 6.438 | 3.141 | 53.025 | 1.587 | 0.352 | 20.114 | 3.000 | 2.556 | 83.775 | 16.225 |
| 208 | Unripe capsules | 47.338 | 38.558 | 10.362 | 39.740 | 6.302 | 0.360 | 11.302 | 14.001 | 3.982 | 86.049 | 13.951 |
| 208 | Fruit coat | 4.249 | 9.135 | 3.231 | 28.770 | 14.901 | 0.449 | 16.100 | 1.139 | 4.783 | 69.373 | 30.627 |
| 208 | Stems | 27.602 | 20.376 | 4.171 | 41.952 | 9.722 | 0.673 | 19.256 | 1.239 | 4.818 | 81.831 | 18.169 |
| 208 | Leaves | 10.605 | 10.371 | 7.949 | 13.446 | 36.197 | 0.745 | 7.018 | 7.926 | 19.012 | 92.293 | 7.707 |
| | Whole plant | 100.000 | 100.000 | 8.235 | 37.986 | 10.414 | 0.462 | 12.209 | 10.898 | 5.534 | 85.738 | 14.263 |
| | *At time of death of plant* | | | | | | | | | | | |
| 240 | Lint | 2.919 | 5.263 | 1.357 | 92.127 | 1.023 | 0.103 | 1.465 | 0.692 | 1.839 | 98.606 | 1.394 |
| 241 | Seed without coat | 7.436 | 6.432 | 26.443 | 2.691 | 11.561 | 0.444 | 4.926 | 44.739 | 5.724 | 96.528 | 3.472 |
| 241 | Seed coat | | 5.852 | 3.842 | 51.526 | 1.642 | 0.224 | 20.009 | 1.423 | 2.539 | 81.205 | 18.795 |
| 243 | Unripe capsules | 20.915 | 14.589 | 10.035 | 39.815 | 6.409 | 0.375 | 11.257 | 13.937 | 3.972 | 85.800 | 14.200 |
| 243 | Fruit coat | 11.991 | 17.554 | 2.099 | 41.733 | 11.243 | 0.559 | 17.595 | 2.179 | 4.484 | 79.896 | 20.014 |
| 244 | Stems | 48.596 | 38.957 | 3.115 | 36.467 | 7.802 | 0.453 | 18.885 | 0.875 | 3.104 | 70.701 | 29.299 |
| 242 | Leaves | 8.143 | 11.353 | 8.820 | 18.421 | 27.240 | 1.039 | 5.749 | 6.618 | 20.936 | 88.823 | 11.177 |
| | Whole plant | 100.000 | 100.000 | 6.045 | 37.470 | 9.934 | 0.494 | 14.304 | 6.508 | 5.567 | 80.322 | 19.698 |

acre, it is calculated that in order to avoid the exhaustion of the reserves of phosphoric acid, potash and nitrogen in the soil, the following manure must be applied to each acre of cotton grown: 1 cwt. superphosphate (20 per cent), 2 cwt. potash salts (30 per cent) and 3 cwt. nitrate of soda, containing 15.5 per cent of nitrogen. If nitrification and the fertilizing matters contained in the irrigation water are taken into account, rather less of the above substances will be needed. Calculations for chalk and magnesia have not been made, as they are so abundant in the soil of the district.

1080 – **Osier Culture in France.** — I. Mir, E. Osier Culture in France in *Vie agricole et rurale*, 6th year, No. 32, devoted entirely to osier culture, Paris, August 5th, 1916, pp. 89-90. — II. Camus, E. G. The various Osiers cultivated in France and in neighbouring countries. *Ibidem*, pp. 95-98, 7 fig. — III. De la Barre, G. The national school of osierculture and basketwork. *Ibidem*, pp. 105-106, 1 fig. — IV. Dr. Bonnardot. Co-operative osier selling. *Ibidem*, pp. 106-107.

I. Forty years ago, France devoted about 175 000 acres to osier culture, and, at this time, she supplied most of the European markets with osiers, especially in Germany, England, Spain and Switzerland. The cultivation of osiers has declined, little by little, until now only about 20 000 to 22 500 acres are grown. Osier culture has suffered because:

*a*) Its progress was hindered at one time by the inability of the growers to organise the sale.

*b*) In many districts the osierbeds were cultivated by hand and, in the absence of sufficient labour, were allowed to become foul.

*c*) Pure varieties were rarely planted, and the vigorous varieties choked out the more delicate ones so that the osier beds were shortlived.

*d*) Attempts were made to establish osier beds on unsuitable soil

II. This article gives a systematic classification of the various osiers cultivated in France, with their scientific and common names. Basket work needs especially the varieties which yield long slender twigs, elastic to bending and to twisting.

The colour and hairiness or roughness of the plants is not important from the botanical point of view, as these conditions depend upon the environment of the individuals, but they must be taken into account in the practical cultivation of the osiers. These characters are maintained by the practice of taking cuttings for planting out osier-beds.

Commercially, much confusion exists between the names used for the cultivated varieties. The same name is often applied, according to the district, to several species or varieties, and the same variety is often known under several different names. The Chamber of French Osier Growers has appointed a Commission of Nomenclature to remedy this state of things. The chief species and varieties of osiers cultivated in France are the following:

(1) *Willows with the scales of the floral catkins selfcoloured, falling off before the ripening of the fruits. — Salix alba* L. (white willow, silver willow). Names recommended by the Commission of Nomenclature.: Osier blanc, suisse, ardennais. Other names: Vuisier, Saouzé, Saudre, Bray. In cultivation, one-year old twigs are often 6 ½ feet long, varying in colour,

often being pale grey, dashed with green, or yellowish, or even olive-green. Very widely cultivated.

*S. Alba* L. var. *Vitellina*, Ser., *S. Vitellina* L. Names recommended: *S. Vitellina*, var. rouge, var. jaune, Amarinier, Osier de tonellerie. Other names: Osier de Metz, osier rouge (a name leading to confusion) osier jaune, Bouton blanc, Grand roux, Saule doré. The branches are longer and more slender and flexible than in the preceding case, with, at the end of the summer, a colour varying from citron yellow to orange yellow or sometimes to coral red. These two species above described yield a much valued type of osier.

*S. fragilis* L. Names recommended:. Saule fragile or Osier fragile, var. pourprée, Osier franc. Other name: Osier rouge (leading to confusion). This osier is weak at the joints, but still it is much used in semifine basketwork.

With these species may be compared *S. pentandra* L. and *S. babylonica* L.

(2) *Catkins appearing before the leaves; scales persistent, discoloured*: *Salix viminalis* L. Names recommended: Osier viminal, O. jaune, O. vert, O. des vanniers, queue de renard, merrin brun. Other names: lusse, pêcher jaune, O. noir de Hollande, O. de longues feuilles.

The shoots reach a length of 10 to 13 feet. This excellent species comprises a rather large number of varieties, of which one is known abroad as the "French Osier".

*S. purpurea* L., *S. monandra* Hoff. Names recommended: O. à une étamine, Sardine, Verdiau. This is known in England as *Dick* with varieties, Dick with red buds, black Dick, old Dick and Dick of the fields. Not very much cultivated.

Near this willow comes *S. rubra* Huds, or the red willow of botanists, which is specially recommended for introduction into cultivation.

(3) *Catkins appearing at the same time as the leaves, scales self-coloured, persistent*: *S. triandra* L. This includes two botanical varieties: *S. amygdalina* L. for which the names osier brun or vache brune are recommended and *S. triandra* L. Brunette, Grisette, Saule à feuilles d'amandier or à à trois étamines.

Other varieties suggested for use in basket work are: — *S. cinerea* L.; *S. daphonides*, *S. Caprea* L., *S. aurita* L., *S. nigricans* Sm., and *S. repens* L., var. *argentea* Koch.

III. The National School of Osier Culture and Basketwork, founded by resolution on Jan. 3rd., 1905, is situated at Fayl-Billot (Haute Marne). The length of training is three years, with a faculty course for adults. A diploma is awarded at the close of the school course to the students who have satisfied the examiners. The school has organised experimental fields where 80 varieties are cultivated. A rational nomenclature is sought. Various cultural methods are investigated dealing with manuring, distance of planting, depth of soil, length and thickness of cuttings, methods of checking parasites, grafting especially on poplar, etc.); and laboratory experiments have also been carried out on the coefficients of torsion and

bending of osiers etc. In addition a course of basketwork has been founded and three workrooms have been established for various kinds of basket making.

IV. For thirty years osier cultivation has been carried on in the department Cote d'Or on soil which is not very damp and which is most unfertile. The plantations occupy about 1500 acres. In 1913 the harvest was exceptional in quantity and quality; this caused a considerable drop in the price offered by buyers, which fell from £1 per cwt. to 9*s* 0*d*. or 9*s* 5*d* per cwt. To remedy this state of affairs, the producers decided to sell their osiers themselves and to this end they formed the Co-operative Society of Aisrey. This society, founded in August 1913, has 140 members, from 15 villages. The results, have been as satisfactory as was hoped, and the drop in price was stopped by the formation of the Society.

CROPS YIELDING OILS, DYES AND TANNINS

1081 – **Nitrogen Requirements of the Olive-tree.** — See No. 1068 of this *Bulletin*.

1082 – **The Dyeing Value of Some Indian Dye-Stuffs.** — SRIVASTAVA, I. P. (Technological Chemist, Cawnpore) in *The Agricultural Journal of India*, Special Indian Science Congress Number, pp. 53-64. Calcutta and London, 1916.

The following investigation into the dyeing values of certain natural colouring matters still used by native dyers was undertaken under the orders of the Director of Industries, United Provinces.

The colouring matters were tried on wool and cotton by some of the more important methods of modern dyeing. The inquiry has so far been prosecuted in regard to the following colouring matters :

(1) HARSINGHAR (*Nyctanthes Arbor-tristis*). — The flowers of this tree, which occurs in abundance in the United Provinces, contain a beautiful yellow colouring matter soluble in water, also in alcohol.

*Harsinghar* gives brilliant yellow shades with all mordants on wool. On wool mordanted with bichrome and oxalic acid previous to dyeing a beautiful brown is obtained. The dyeings on wool possess good fastness to milling with soap and soda.

(2) TUN (*Cedrela Toona*). — This tree is said to occur largely in the sub-Himalayan forests. The colouring matter is contained in the flowers which are dried and sold. The principal constituent of the flowers is a yellow dye.

*Tun* dyes the best shade on wool which has been previously mordanted with aluminium sulphate and tartar. The dyeings on wool are, however, not very fast to milling with soap and soda.

(3) TESU or DHAK (*Butea frondosa*). — This tree is found in abundance all over the United Provinces. The flowers contain a yellow colouring matter.

*Tesu* dyes on wool shades varying from brown to dull crimson according to the mordant used. The dyeings are fairly fast to milling.

(4) HALDI or TURMERIC (*Curcuma longa*). — The plant which yields *haldi* is grown all over the United Provinces. *Haldi* is a dried rhizome or tuber and is a well-known constituent of curry powder. It contains a

brilliant yellow colouring matter which however possesses the serious drawback of being changed into red by soap or by alkalis.

The colouring principle is called *curcumin*; it is sparingly soluble in cold water, more freely in hot water, and completely in alcohol.

The best shade is obtained on wool previously mordanted with bichrome and oxalic acid. The fastness of the dyeings on wool is fair.

(5) ARUSA (*Adhatoda vasica*). — The leaves of this plant yield a yellow colour. *Arusa* is an ever-green plant and is found in the United Provinces. The colouring matter is soluble in water and also in alcohol. On wool the best shade is obtained on the same mordant as above. The fastness of the dyeings on wool is fair.

(6) NASPAL or POMEGRANATE RIND (*Punica granatum*). — The rind of the fruit contains a tanning substance and also a yellow colouring matter.

Pomegranate rind dyes very good shades varying from yellow to full brown on wool. All these possess very good fastness to milling.

(7) JANGLI NILL or WILD INDIGO (*Tephrosia purpurea*). — This is a small woody annual occurring in abundance in the United Provinces.

Clarke and Banerjee have discovered in the leaves of this plant a colouring principle allied to quercetin or quercitrin (vide *Trans. Chem. Soc.* 1910, V, 97). Owing to the difficulty of separating the yellow principle from the chlorophyll, efforts to obtain a pure yellow from *Tephrosia* have only been partly successful. The colouring matter is, however, of great value, as it yields dyeings which are compratively fast to light, washing and milling. On account of the abundance of the plant it may be worth while devising a suitable process for extracting the yellow colouring principle. A decoction of the leaves of *Tephrosia* dyes wool mostly dull brown shades in conjunction with the various mordants, the most brilliant shade being that on tin mordant. The dyeings, however, possess very good fastness to milling.

(8) SAFFLOWER or KUSUM (*Carthamus tinctorius*). — The dried flowers of safflower plant contain a colouring matter which before the introduction of coal-tar colours was higly prized all over the world. It produces on cotton beautiful shades of red varying from a full crimson to the most delicate pink.

Although the yellow colouring matter in safflower is generally regarded as useless, Hubner has shown that certain mummy cloths which he examined had been dyed with safflower yellow. The Egyptians were therefore acquainted with the right way of using safflower yellow.

Safflower yellow does not dye cotton in conjunction with aluminium and tin mordants. Wool, however, possesses affinity for the yellow colour and may be dyed direct.

(9) MAJITH (*Rubia cordifolia*). — The root and twigs, of this plant contain a dye-stuff identical with madder. *Majith* was largely used in India before the advent of synthetic alizarine. It is undoubtedly one of the most valuable indigenous dye-stuffs., Wilth its help red, maroon, and bordeaux shades of excellent fastness to light can be dyed on all fibres. It is the basis of a great many colours required by the calico-printers. *Majith*,

as might be expected, dyes very fast shades on both wool and cotton. The best results on cotton are obtained by using the Turkey Red process.

(10). CUTCH or KATHA (*Acacia catechu*). — The catechu tree is found in several parts of India. Catechu may be applied to all fibres, though it is most largely used for dyeing cotton. Catechu brown is one of the fastest colours known.

(11) PATANG or SAPPAN WOOD. (*Coesalpinia sappan*). — This tree is said to grow abundantly in Cuttack and in Central India. The colouring principle *brazilein* exists in a colourless condition in the freshly cut wood and is by oxidation converted into the true colouring matter *brazilein. Patang* is a valuable colour-yielding material. It can be used for producing brilliant shades of red, crimson, and purple and is very suitable for calico-printing.

(12) LAC DYE. — This substance is of animal origin.

Lac dye is manufactured largely in the North Western Provinces, though like other natural products it has lost much of its former importance. Lac dye is dyed on wool; chiefly on tin mordant. It yields beautiful scarlet and crimson shades.

(13) INDIGO. — The use and importance of Indigo are too well known to need any comment.

(14) KACHNAR (*Bauhinia racemosa*). — This is a shrub very common in the North Western Provinces. The bark yields a red dye which is largely associated with tannin. The dye is not very bright but nevertheless it may be employed for dyeing dull reds on cotton. It may be dyed on cotton without the help of any mordant. The bark can be had in any quantity and may be of service to tent manufacturers who require a dull red colour for the inside of tents.

(15) PEEPUL (*Ficus religiosa*). — The roots of this well-known plant were examined and found to contain a red dye which gives a good pink on cotton mordanted with alumina. The shade so obtained is fairly fast.

(16) RED SANDERSWOOD (*Pterocarpus santalinus*). — This is a small tree occuring in Southern India. The wood yields a valuable red dye called santalin.

Sanderswood dyes wool without any mordant. Very good shades of satisfactory fastness are obtained on cotton, on tin and alumina mordants. The dye does not dissolve in water though it is freely soluble in alcohol and acetic acid.

(17) ROLI or KAMELA POWDER (*Mallotus philippinensis*). This dye is obtained from a small tree found along the foot of the Himalayas and in Southern India. The fruits have red glands on the surface of the capsule and the powder is obtained by crushing or breaking up these glands. Kamela gives a beautiful yellow on silk mordanted with alumina. The dyeing must be done in an alkaline bath.

(18) AKHROT (*Juglans regia*). — The bark yields a valuable brown dye.

(19) KATHAL (*Artocarpus integrifolia*). — The wood yields a yellow

dye which may be dyed on cotton on alumina mordant. The shades obtained are good and fast.

(20) BARBERRY (*Raswat*). — The bark, roots, and stem of this plant are rich in a very good yellow dye. This plant is plentiful in the Kumaun Hills.

*Raswat* is used chiefly as a dye for silk. It was dyed on cotton mordanted with alumina, but dull shades were obtained. This was perhaps due to the presence of chlorophyll in the preparation which came from Naini Tal.

(21) *Rhus cotinus*. — The wood of this plant yields a dye similar to young Fustic. On cotton mordanted with alumina an orange yellow colour was obtained ; with tin an orange red was obtained. The dyeings are, however, not fast to alkalis and soap.

1083 – **The Harvesting and Cultivation of Medicinal Plants in France.** — *Feuille d'Information du Ministère de l'Agriculture*, 21st year, No. 28, pp. 12-13. Paris, July 14th, 1916.

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL PLANTS

The question of the production of medicinal plants in France, as in other countries (1) is one of great importance. The history of the cultivation and harvesting of medicinal plants is given in this paper and the fact is recalled that the list of simple indigenous drugs inscribed in the Codex of 1908 comprised not less than 110 species. Although most of the indigenous medicinal plants grow naturally over large areas, yet several among them grow best and most abundantly in certain districts where the temperature and soil are specially favourable to their development and to the elaboration of their active principles ; so much so that the same species, cultivated in neighbouring districts differing in soil and exposure, will in the one case acquire a very great toxicity, while in the other its properties are much less active. Digitalis is a striking example of this type of medicinal plant ; that grown in the Vosges is very rich in digitalin, while that from the Ardennes contains but very little. This instance shows that the cultivation of certain plants demands special precautions, definite knowledge and scientific control. To entrust the work to inexperienced hands would be to vitiate the results.

The article outlines the principles which should govern the cultivation and harvesting of the plants and gives, besides indications of the price and the extent of sale of each, the following list of the chief medicinal plants grown in France, classified according to the part which is of use :

*Flowers* : Arnica, blue-bottle (with calyx), mullein, borage, colchicum, poppy, marsh-mallow, lavender, mallow, milfoil (clusters), lily-of-the-valley, white dead-nettle (without calyx), ground ivy, chamomile, elder, lime (bracts), coltsfoot, Auvergne violets, pasque flower, meadow sweet (clusters), hawthorn, bugloss, marjoram, broom.

*Leaves* : Wormwood, agrimony, silverweed, woodruff, cranesbill, borage, shepherd's purse, yellow cheese-rennet (clusters), catmint, blackcurrant, eyebright, ash, goat's rue, yellow melilot (cut tips), mercury, St. John's wort, lily-of-the-valley, walnut, poppy, plantain, meadow sweet, bramble, soapwort, henbane, ground ivy, balm-mint, thorn apple, night-shade, hart's tongue, wild thyme, figwort, tansy, valerian, veronica, vervein.

(1) See *B.* July 1916, N. 757. (*Ed.*).

*Roots*: Restharrow, elcampane, bistort, bryony, carex, couchgrass, comfrey, chicory, dock, dandelion, polypody, soapwort, Solomon's seal, tormentil, valerian.

*Bulbs*: Colchicum.

*Fruits*: Whortleberry, caraway.

*Buds*: Poplar, pine.

*Various*: Cherry stalks, Horse Chestnut.

*Marine plants*: Corsican Moss, laminaria.

Some plants because of the high prices that they command on account of the variety of ways in which they are used and their world-wide consumption, are cultivated on a large scale. The most notable among these are: belladonna, (of which the price has risen from about 7 ½ *d* to 8*s* 6*d* per lb); marsh mallow, mallow, mullein, henbane, borage, chamomile, peppermint, valerian, aconite, balm, hyssop, sage, male-fern, black-currant, horse-radish, scurvy grass, parsley, coriander, angelica, small-centaury, gentian, sweet marjoram. Attention is also drawn to the cultivation of saffron and mustard.

HORTICULTURE

1084 – **Summer Treatment of Greenhouse Soil.** — GREEN, W. J. and GREEN, S. N. in *Ohio Agricultural Experiment Station, Bulletin* No. 281, pp. 53-68, 5 fig. + 2 diagrams. Wooster, Ohio, 1915.

For an interval of six to ten weeks during midsummer, vegetable greenhouses usually stand idle, because vegetables grown in the open air are abundant and cheaper. The greenhouse grower does not consider it necessary to renew the soil annually, an operation which is decidedly costly. The general opinion is that the intense heat under glass during July and August, together with the dryness of the soil, will destroy all insect life as well as fungi and bacteria. This view is open to serious doubt. In order to determine the practical difference between the various methods of treating the soil during the summer months when cultivation is stopped, experiments have been carried out at the Ohio Station greenhouses. The following methods of treatment have been compared:

*New Soil Plot.* Each year, just before the crop was to be planted in the autumn, the entire soil of this plot was removed and replaced with fresh soil. This soil was the ordinary "Sod compost" prepared according to the usual Ohio methods. The spring crop of tomatoes received a light mulch of manure.

*Straw Mulch Plot.* This and the succeeding plots were of soil that had been cropped for at least three seasons. Immediately after the crop was removed each spring this plot was given a covering of from four to six inches of wheat straw. Both the straw mulch and the manure mulch plots were kept well watered during the summer, though excessive wetness was avoided. Most of the straw was removed before preparing this bed for the autumn crops, as it decayed but little and could not be worked into the soil. A covering of straw was given to the spring crop of tomatoes, just as the fruit began to ripen.

*Manure mulch plot.* This plot was treated in the same way as the preceding one, except that the straw was replaced by a mulch of very fresh manure. The latter was sufficiently decomposed by autumn to

be worked into the soil before planting. A mulch of manure was also given to the spring crop of tomatoes.

*Dry-Plot.* During the time between seasons in the summer this plot remained bare and unwatered. Before the autumn crops were planted it received fresh manure which was worked into the soil. The spring crop of tomatoes also received a mulch of manure.

On the plots thus treated two crops of tomatoes were grown each year, one in autumn and one in spring. The figures given in Table I sum up the results obtained from 1908 to 1914.

TABLE I. — *Tomato Crop ; Average Weight per Plant.*

| Plots | Autumn Crop (1908-1913) | Spring Crop (1909-1914) |
|---|---|---|
| | lbs. | lbs. |
| New soil | 4.1 | 8.4 |
| Straw mulch | 3.4 | 6.3 |
| Manure mulch | 3.7 | 7.4 |
| Dry plot | 2.1 | 6.8 |

In addition lettuces were grown from 1911 to 1913, and Table II gives the results obtained during this period, as a general average of spring and autumn crops.

TABLE II. — *Lettuce Crop ; Average Weight per Plant.*

| Plot | Spring and Autumn Crops 1911-1913 |
|---|---|
| | oz. |
| Soil cultivated and manured for 10 years | 4.40 |
| New soil | 3.55 |
| Straw mulch | 2.98 |
| Manure mulch | 4.18 |
| Dry plot | 4.11 |

From the results of these experiments and from others carried out with cucumbers, the following conclusions are drawn :

1. The common greenhouse crops of Ohio, tomato, cucumber and lettuce, require different soil conditions for maximum yields.

2. Lettuce can be grown continuously with safety on unrenewed soil with application of manure.

3. Tomatoes and cucumbers are sensitive to conditions found in

old soil and the yields are quickly affected, necessitating treatment or renewal of soils after two or three seasons' use.

4. The drying of the soil during the idle summer period seems to adversely affect the soil conditions for tomatoes, but not for lettuce.

5. Summer manure mulch is recommended to check adverse soil conditions for tomatoes and cucumbers.

6. Summer mulch may not obviate the necessity for soil sterilisation, but, in part, it appears to answer that purpose.

FRUIT GROWING

1085 – **California Grapefruit.** — SHAMEL, A. D. in *California State Commission of Horticulture Monthly Bulletin*, Vol. IV., No. 7, pp. 239-249. Sacramento, Cal., July 1916.

The early plantings of grapefruit in California were made with Florida varieties which were selected without much knowledge of their adaptability to California conditions.

It is only in recent years that any data has been gathered as to the comparative value of several varieties with regard to their adaptability. Among these varieties the Marsh Seedless takes the first place.

It has also become evident from these studies that the grapefruit planted on rather light, porous and sandy soils produce fruit of a superior commercial quantity, colour and texture of rind to those planted on the heavier clay soils. While most of the older plantations were made in the lower valleys, most of the more recent plantings have been made on higher lands having lighter soil of more suitable texture. The other Florida varieties most largely grown in California are the Triumph and Duncan.

The orchards of Triumph grapefruit in Southern California are very productive, but the fruit is rather small and contains numerous seeds, from 25 to 50 ; this seriously hinders its spread in the commercial orchards.

The Duncan grapefruit trees tend to produce large round fruits, but these also contain too may seeds for market purposes. The other varieties cultivated to a certain extent are the Imperial, Colton Terrace Seedling, Aurantium, Commercial and the Blood. The results so far obtained with those varieties can hardly be considered successful, so that the variety Marsh or Marsh Seedless will gradually replace all the others.

According to Vaile 600 acres of grapefruit trees are in bearing in California, capable of yielding 250 carloads of fruit per annum. 1 100 additional acres of trees under five years of age will soon double the present output.

According to the same writer, Florida has 16 000 acres of grapefruit trees in full bearing, yielding 8 000 carloads of fruit, and in addition about 45 000 acres of trees under five years of age which will eventually yield at least 35 000 carloads of fruit.

Porto Rico, in 1913, exported to the United States 500 carloads of fruit, and Cuba, in 1912, 250 carloads. The export from Jamaica is also rapidly increasing. Although the cultivation of grapefruit in California is esta-b lished on a sound basis, Vaile thinks that much prudence should be exercised in the future extension of the orchards. Two facts must be borne in mind in this connection. First of all, the importation of grapefruit into California has been stopped in order to prevent the introduction of insect pests and fungous diseases by this means, and probably other States where the

grapefruit is cultivated will take similar steps. This will force California to provide for its own consumption by its own production. Secondly, the period of ripening of California Marsh Seedless grapefruit is during the summer months when no other district has a ripe crop available to supply the Eastern markets. The success of the grapefruit industry in California will largely depend upon a careful study, by the growers, of the condition of fruit ripening and on the adoption of a commercial standard of ripeness. In this connection the analyses made by the Laboratory for Agricultural Chemistry at Los Angeles on various samples of grapefruit from California and Florida are of special interest. The average composition of the « standard » grapefruit of the variety Marsh Seedless, grown on one of the best southern plantations, is as follows :

| | |
|---|---|
| Average weight per fruit | 20 1/4 oz. (574 gm) |
| Rind | 28.72 per cent |
| Pulp | 71.03 per cent |
| Juice | 69.63 per cent |
| Number of seeds, per fruit | 10.0 |
| Total solids in pulp | 12.92 per cent |
| Soluble solids in juice | 11.52 per cent |
| Total sugar in juice | 7.50 per cent |
| Acid in juice | 1.28 per cent |
| Solids acid ratio | 9.0 |

It may be taken as proved that the "standard " type of the Marsh Seedless variety can be isolated in propagation by bud selection based on the records of the performance of individual trees. This method of selection was put forward at the California Fruit Growers' Convention at Visalin, and if intelligently applied it will probably result in a great improvement in the type, both as regards quantity and quality of production.

## LIVE STOCK AND BREEDING.

1086 – **The Effects of Snake Venom on Domestic Animals and the Preparation of Antivenomous Serum.** — MITCHELL D. T. in *The South African Journal of Science*, Vol. XII, No. 9, pp. 237-354. Capetown, April, 1916. HYGIENE

Investigations undertaken in the last quarter of the nineteenth century have shown that the active principles of snake venom are soluble proteins belonging to the same class as enzymes and toxins ; they have also proved that the immunisation of animals against bites can be effected in the same manner as against contagious diseases, and that the serum of immunised animals possesses specific antivenomous properties. A classified list of venomous snakes and a description of the venom organs (glands, canals and fangs) are given.

The quantity of venom which can be obtained from a snake at one time depends on a number of factors, namely : the species, the condition and size of the individual, the length of time which has elapsed since the last meal, and the interval since its last bite ; this quantity is also influenced by the

duration of the eventual captivity of the snake. The largest quantity can be obtained from the king cobra and the smallest from some species of *Hydropinae*. From a cobra (*Naja Haje*) 200 mgms. of dried venom, corresponding with 670 mgms. of the fresh substance, have been obtained in the course of an experiment which lasted four months.

The principal physical characteristics of the venoms, which vary greatly according to the species ; colour, taste, state after drying, and solubility, are described. The general action of venoms is then considered, and after a recapitulation of the different researches on the question, the conclusion is drawn that these products are very complex liquids containing some of the following constituents, all of them not being present in every venom.

1) *Neurotoxins.*

*a*) Acting principally on the respiratory centre.

*b*) Acting principally on the vaso-rotatory centre.

*c*) Acting principally on the nerves and the discs of the fibres of the striated muscles, particularly of phrenic muscles.

2) *Agglutins.*

3) *Cytolysins.*

*a*) Haemolysins.

*b*) Leucolysins.

*c*) Haemorrhagins.

4) *A fibrin enzyme.*

5) *A proteolytic enzyme.*

6) *Antibactericide substances.*

The neurotoxins constitute the most active principles of most venoms.

The effects of the bite of venomous snakes are then described . The neurotoxins, which have an affinity for the respiratory centres, predominate in the venom of the *Colubridae*. This class, of which with regard to the action of the venom, *Naja tripudians* is typical, produces general paralysis with a specific paralysis of the respiratory mechanism. In the venom of the *Viperidae* the toxins acting on the blood and circulatory system predominate ; this venom, particularly that of *Vipera russellii*, acts on the blood and circulatory system producing a sudden appearance of various symptoms, with a tendency to an extension of the gangrenous destruction from the local lesion, if the animal survives the acute stage.

The first scientific attempt to immunise against snake venom was made in 1887, SEWALL having then immunised pigeons by small repeated doses, so that they were afterwards able to withstand ten times the fatal dose of *Crotalus* venom. In 1892 CALMETTE employed venom heated at 80° C to immunise rabbits, but his serum, being originally from *Colubridae*, had but little action for the *Viperidae*. Pure specific sera have since been prepared by others, for example:

Lamb's serum, derived from *Naja tripudians* (strongly antitoxic against cobra venom).

Lamb's serum, derived from *Vipera russellii* (anti-toxic against *Viperinae* venom).

Noguchi's serum, derived from *Crotalus* (anti-toxic against *Viperinae* venom, but without effect against cobra venom).

Noguchi's serum, derived from *Ancistrodon* (anti-toxic against *Viperinae* venom but not against *Colubrinae* venom).

Attempts have been made with some success, to prepare a polyvalent serum, without however as yet, providing one sufficiently polyvalent to satisfy all requirements.

Practical details of the way of preparing the serum by Calmette's method and by the Watkins-Pitchford method, used in Natal, are given. In order that the estimation of the efficacity of the serum should be valuable, the minimum fatal dose of the venom must be known and this varies with each snake. The following table, resulting from a series of experiments carried out in the Pietermaritzburg laboratory and made on the commonest snakes of South Africa, is published.

| Snake. | Animal employed | Minimum fatal dose per kg. of animal employed. Intravenous injection. | Hypodermic injection. |
|---|---|---|---|
| *Bitis arietans* | Rabbit | 0.5 mgms. | 1.7 mgms. |
| *Dendrastis* sp. | " | 0.225 " | 0.325 " |
| *Naja nigricollis* | " | 0.9 " | 1.25 " |
| *Naja flava* | " | 1.5 " | 2 " |
| *Causus rhombeatus* | " | 4 " | 7.5 " |
| *Sepedon haemachates* | " | 0.21 " | 3 " |

The Pietermaritzburg laboratory has prepared a polyvalent serum against the venoms of the mamba, the puff adder (*Bitis arietans*) and the cobra (*Maja* spp.). According to the writer the preparation of a polyvalent serum requires much time ; moreover the animal which should have been hyper-immunised is likely to die, and finally the serum obtained has not always a satisfactory efficacity towards all its components. It is preferable to prepare a polyvalent serum by simply mixing the monovalent sera of maximum strength.

1087 – ***Deraiophoronema cameli*, a New Species of Filaria from the Camel's Lung**. — ROMANOVITCH, in *Comptes rendus des séances de la société de Biologie*, Vol. LXXIX, No. 15, pp. 745-746. July 1916.

In the Kirghiz steppe two cases of the death of a camel have been recorded, caused by a new filaria of the lungs. The parasite has been investigated at the Veterinary Laboratory of Petrograd and named *Deraiophoronema cameli* n. g. n. sp.

1088 – **Metabolism of the Organic and Inorganic Compounds of Phosphorus.** — FORBES, E. B., in collaboration with BEEGLE, F. M., WHITTIER, A. C., FRITZ, C. M., COLLISON, R. C., WOODS, H. S., and KNUDSEN, C. W., in *Ohio Agricultural Experiment Station, Technical Series, Bulletin* No. 6, 80 pp. 23 fig. Wooster, Ohio, 1914. FEEDS AND FEEDING

This comparison of the nutritive value of different phosphorus compounds was undertaken as part of a general study of the metabolism of inorganic substances in relation to the practical feeding of man and animals.

The experiments were made on pigs, with normal standard rations, composed principally of relatively simple manufactured products of vege-

table and animal origin (hominy, which consists of decorticated and germ free maize grains, blood albumen, wheat gluten, maize bran, and agar-agar) to which the phosphorus compounds have been added in the form of almost chemically pure substances. All the rations also contain sodium chloride. The writers have noted that the results cannot be extended to the same compounds when found in foods under natural conditions. Moreover it is stated that according to the literature the lecithins and phosphoproteins (not included in these experiments) have higher nutritive values than all the compounds here studied, *i. e.* phosphates, hypophosphites, nucleic acid, phytin and the glycerophosphates.

Five experiments were made. The first (April and May 1908) consisted of a metabolism experiment lasting ten days made with four pigs ; the second (November to December 1908) consisted of a feeding experiment (56 days) and analyses of the carcases (30 pigs) ; the third and fourth (November 1909 to January 1910) were of the same type as the second and were performed with 35 and 45 pigs respectively ; lastly the fifth (March to June 1913) was a carefully controlled series of experiments of metabolic equilibrium for the comparison of glycerophosphates and phosphates which was completed with a slaughter test and the thorough chemical study of the carcases of the six subjects experimented with.

The results are given in numerous comprehensive tables and are summarised and discussed in the following manner.

The results of experiment I show clearly that the phosphorus of orthophosphates, hypophosphites and the nucleic acid of beer-yeast, added in a pure state to rations poor in phosphorus but capable of maintaining the phosphorus equilibrium, can be absorbed by pigs and retained in the organism in considerable quantities for at least ten days. It has certainly not been proved that each of these compounds can be permanently retained, but that seems quite probable. In the case of the hypophosphites this would necessitate a further oxidation of the phosphorus to the form of orthophosphate.

In the conditions of experiments II, III and IV, some results suggest that, from a nutritive point of view, the glycerophosphates would be superior to the orthophosphates, nucleic acid, phytin and hypophosphites, especially in respect to the proportion of muscular tissue and fat in the increase of live weight, and the breaking strength of the bones and their ash-content per cubic centimetre ; but the facts are not sufficiently concordant to establish this conclusion firmly.

It is concluded from the results of experiment IV that the mineral constituents and the ethereal extract of the blood are notably affected by the diet, which also modifies considerably the salts composing the bones, both as to their quantity and their relative proportions.

Experiment V gave a very uniform and consistent series of observations of different kinds, proving that, anyway in the artificial conditions of this experiment, there are no essential differences in the mineral metabolism, the digestibility of the food, and the amount and composition of the growth of swine, as affected by phosphates and glycerophosphates. It seems

quite possible that the amount of exercise taken by the pigs, as determined simply by the state of feeling induced by the ingested phosphorus compounds, quite independently of the fundamental nutritive effects, may have entered into the determination of the relative development and even into the composition of the different parts.

Certain differences observed in the composition of the tissues can be attributed to variations in the liquid content of the parts, the salts varying accordingly, or to the composition of the supporting structures, or the unorganised nutritive matters.

While the hypophosphites, nucleic acid and phytin have not been submitted to so complete a study as that devoted to the comparison of the phosphates and glycerphosphates, no fact having led the writers to investigate the question, they consider that when added in their ordinary " chemically pure " form to rations poor in phosphorus such as those studied, these five compounds do not differ in their nutritive effects on the gross composition of the growth of the animals, except in so far as affected by the relative tolerance of the pigs towards these preparations and the consequent influence on the spirits and activity of the animals.

The writers think it possible to arrange the compounds in decreasing order of toleration, thus : glycerophosphates, phosphates, phytin, nucleic acid (from beer-yeast) and hypophosphites, the compounds being administered in doses containing equal amounts of phosphorus ; nevertheless the order of the last two compounds is uncertain. It has not been shown that these differences in acceptability were directly related to the fundamental nutritive effects. If they have been established for the chemically pure compounds they certainly do not exist in foods containing these compounds combined naturally.

When phosphorus is added to a ration in the form of very soluble compounds a much smaller amount will be tolerated by the animal than when the phosphorus is supplied in its natural form in food.

Owing to the great difficulty of making the animals eat the nucleic acid, commercial phytin and the corresponding compound obtained from wheat-bran, it is concluded that the isolation of such compounds from the natural products alters at least their therapeutic effects. So that it is impossible to draw any conclusion on the nutritive value of these compounds present in ordinary food from experiments made with the pure extracted substances.

It has not been established that the organic compounds used in this investigation have a higher feeding value than that of inorganic compounds of phosphorus. No fundamental differences in the nutritive value of the compounds of phosphorus studied were established. No basis therefore, was discovered for a differentiation between the nutritive values of organic and inorganic compounds of phosphorus generally.

Even admitting debated superior nutritive value of organic phosphorus compounds, there is no doubt that the quantity of organic phosphorus contained in the body is a very small part of the total phosphorus, and it is certain that in the diet of all omnivorous and herbivorous animals (*i. e.* of all

domestic animals) there is a much greater ratio of organic to inorganic phosphorus, than in the bodies of these animals. Therefore each time it is necessary to increase the total quantity of phosphorus of a ration this result can be completely achieved by giving the phosphorus in the form of inorganic compounds.

It appears improbable that, for young or adult animals, any diet whatever, composed of natural foods and satisfying the nitrogen requirement, will fail to furnish enough phosphorus to maintain the equilibrium of this element. It is however certain that many rations composed of common foods do not contain the quantity of phosphorus necessary to assure the maximum assimilation of this element and the maximum development.

The results of the experiments indicate that the possibility of influencing to a practical extent, the relative development of the tissues and organs of domestic animals by adding isolated compounds of phosphorus to the ration, is probably limited to the density and strength of the bones. However, the increase of the resistance and density of the bones obtained by adding phosphorus compounds to the normal diet is accompanied by only a small possible increase in the external dimensions.

In order to increase the strength of the bones of growing animals, the most practical form in which to administer the phosphorus for this purpose is probably any preparation of bone readily eaten by the animals. Precipitated bone phosphates are readily taken by all kinds of farm stock.

The diets experimented with were deficient in phosphorus and calcium but the animals possessed quite a limited tolerance towards each of these elements in the form of their pure salts. The addition of marked quantities of calcium carbonate always produced digestive troubles ; although the deficiency in phosphorus was such that the bones were quite insufficiently nourished, it was not possible to administer more than 25 to 40 per cent of the total phosphorus in the forms it was desired to study. The attempt to increase the mineral base of the rations by the addition of potassium and sodium citrate were no more successful.

1089 – **The Influence of the Nature of the Diet on the Retention of Protein.** — UMEDA N., in *Biochemical Journal*, Vol. X, No. 2, pp. 245-253. London, June 1916.

The question of the capacity of the organism to store protein has always been one of considerable interest and although it is highly probable that such a storing is a normal process, the critical conditions for its occurrence have not yet been fully elucidated, largely owing to the fact that the amount of information available from nitrogen equilibrium studies is small and its value difficult to assess. Still by the use of the method of superimposition results of importance can be obtained without recourse to such favouring conditions of storage as muscle work, growth or inanition, all of which conditions introduce secondary factors which render the interpretation of the data more difficult.

In the course of another investigation Tsuji (1915) found that the degree of retention of superimposed protein varied (1) with the nature of the standard diet, and (2) with the nature of the protein superimposed. As these experiments were, as regards the superimposition, only of one

day's duration the present series of experiments was carried out to amplify the data obtained.

The animal employed was an Airedale bitch weighing 17.6 kilos. She was fed daily at 11 a. m. after catheterisation, the urine then obtained being added to the urine collected in the receiver of the metabolic cage.

The analytical methods employed were: total nitrogen, Kjeldahl; urea, Plimmer and Skelton's modification of the urease method, ammonia, Folin. The delimitation of the faeces was carried out by means of charcoal or carmine. The total faeces was collected for each period and a single analysis of the mixed specimens was made.

As regards the standard diets employed three different combinations of protein, fat and carbohydrate were used. They all contained the same amount of protein and were of the same caloric value but varied markedly in their content of fat and carbohydrate. They were as follows.

I. *Carbohydrate-rich, fat-poor diet.*

| | | | |
|---|---|---|---|
| Scott's oatflour . . . | = 120 g. | | |
| Dried skimmed milk | = 43 g. | | |
| Margarine . . . . . | = 34 g. | Nitrogen . . . | 7.2 g. |
| Caseinogen . . . . . | = 19 g. | Carbohydrate. . | 194 g. |
| Tapioca . . . . . | = 93 g. | Fat . . . . . | 34 g. |
| Sodium chloride . . | = 2 g. | Caloric intake . | 1296 |

II. *Intermediate diet.*

| | | | |
|---|---|---|---|
| Scott's oatflour . . . | = 60 g. | | |
| Dried skimmed milk | = 62 g. | | |
| Margarine . . . . . | = 77 g. | Nitrogen . . . | 7.2 g. |
| Caseinogen . . . . . | = 19 g. | Carbohydrate. . | 117 g. |
| Tapioca . . . . . | = 47 g. | Fat . . . . . | 68 g. |
| Sodium chloride. . . | = 2 g. | Caloric intake . | 1296 |

III. *Fat-rich carbohydrate-poor diet.*

| | | | |
|---|---|---|---|
| Scott's oatflour. . . | = 30 g. | | |
| Dried skimmed milk | = 40 g. | | |
| Margarine . . . . . | = 120 g. | Nitrogen. . . . | 7.2 g. |
| Caseinogen. . . . . | = 34 g. | Carbohydrate. . | 42 g. |
| | | Fat . . . . . | 101 g. |
| Sodium chloride . . | = 2 g. | Caloric intake . | 1296 |

The standard diet was continued for a pre-period of five to eight days until the nitrogen output was approximately constant, there was then added to the diet a definite amount of protein material, and this was continued for eight days when the diet again reverted to the original standard for a post-period of six or eight days. It was thought that in this way some definite information as regards retention would be obtained.

A short bibliography is given and tables show the results of the five experiments, which were as follows:

*Experiment I.* Retention of caseinogen nitrogen on the carbohydrate-rich fat-poor diet.

*Experiment II.* Retention of caseinogen nitrogen on the intermediate diet.

*Experiment III.* Retention of caseinogen nitrogen on the fat-rich, carbohydrate-poor diet.

*Experiment IV.* Retention of gelatin nitrogen on the carbohydrate-rich, fat-poor diet.

*Experiment V.* Retention of gelatin nitrogen on a fat-rich, carbohydrate-poor diet.

The conclusions were as follows :

1. Nitrogen in the form of protein added to a carbohydrate diet is retained in greater amount than when added to a fat diet of equal caloric value.

2. Nitrogen given in the form of caseinogen is more completely retained than when given in the form of gelatin.

3. The addition of meat extract to gelatin does not increase the amount of nitrogen retained.

The paper does not deal with the problem as to how the carbohydrate acts, but it will possibly be treated in another paper.

1090 – **The Influence of Phosphates on the Feeding of Cattle.** — PICCININI MARIO in *La Clinica Veterinaria*, 39th year, No. 13-14, pp. 383-394. Milan, July 30, 1916.

Investigations were carried out on the influence which the different compounds of phosphorus have on the growth of young animals . As it was intended to treat the latter from their birth, a preliminary investigation was made to determine whether it is possible to influence the amount of phosphorus in the milk of the mothers by the administration of different phosphorus compounds. This preparatory work was carried out on three cows belonging to the Zootechnic Institute of the Royal Veterinary School of Naples. The phosphorus was administered in the form of bone powder (23 per cent phosphoric acid), dicalcic and tricalcic phosphate (44 per cent phosphoric acid), calcium glycerophosphate (25 per cent phosphoric acid) and a cereal decoction. During the course of the investigation the three cows always received the same diet. The milk from each stage was exactly weighed, from it a sample proportional to the quantity produced was withdrawn and this was employed for the estimation of the phosphoric acid.

The trials covered five periods, each of which can be divided into three parts. In the first, lasting eight days, the animal received the ordinary diet and this period served to render constant the phosphoric acid content of the milk produced. In the second, lasting from three to six days, the compound, of which it was desired to determine the influence, was administered. In the third, lasting eight days, the feeding reverted to the normal and the administration of phosphorus was suspended. The last period served to indicate how long the influence of the phosphatic substance administered in the preceeding period persisted.

From the amounts of phosphoric acid found in the milk before, during

and after the administration of the different phosphates to the animals it seems that certain slight modifications can be effected in the phosphoric acid content of the milk. However, the administrations have no fixed influence and do not produce a constant regular increase proportional to the quantity of phosphate administered, on the contrary they seem almost to exercise a disturbing influence. Indeed, whilst an unexpected uniformity in the phosphoric acid content of the milk produced by the animals under observation is observed before the phosphates have been administered to them, this uniformity ceases three or four days after the first administration.

Thus, in the eight days which preceded the first administration of bone powder (150 gms. the four first days and 200 gms. the two last) to cow No. 1, the phosphoric acid content of its milk varied from a minimum of 2.8 per cent to a maximum of 2.94 per cent, but on the third day after the first administration of bone powder, there was a marked depression in the phosphoric acid content (2.63 per cent) which increased the following day (3.24 per cent) and then underwent a new and considerable depression (2.02 per cent). These alternate high and low figures continue for seven or eight days from the last administration of bone powder. Almost the same observations were made with cow No. 2. Uniformity in the phosphoric acid content (3.04 per cent to 3.45 per cent) of its milk before the tricalcic phosphate had been administered, a depression (2.63 per cent) the third day after its administration (80 gms. per day for seven days) then the oscillations, which however did not extend above the preceding mean content, and finally, seven days after the last administration, a reversion to the original regular and constant figure. With cow No. 3 there was a marked increase in the phosphoric acid content of its milk on the third day after a single administration of 200 gms. of dicalcic phosphate. The content reached 3.28 per cent although previously it oscillated between 2.84 per cent and 2.95 per cent. Then there were alternate increases and decreases, and only after seven days did the phosphoric acid of the milk revert to within the limits of the original mean value.

Calcium glycerophosphate gave the same result, the experiment being made four months after that with bone powder. The third day after its administration to cow No 1 a depression in the phosphoric acid content of its milk was evident ; the amount decreased to 2.84 per cent, although it had previously oscillated between 2.99 per cent and 3.19 per cent ; this depression was maintained on the following days, and it was only on the fifth day after the first administration of glycerophosphate (the third from the last administration, when twice the preceding quantity — 200 gms. — was given) that there was a slight increase above the ordinary content (3.29 per cent) ; then there was a fresh depression which, always less marked, was maintained the whole time that the estimation were made.

The same results were obtained by administering to the same cow cereal decoctions containing from 0.56 to 1.1 gms. of phosphoric acid per litre. The second day after the first administration a large decrease in the phosphoric acid content of the milk (from 3.29-3.26 per cent to 2.68 per

cent) was observed ; this depression was maintained on the two following days. On the fifth day after the first administration, the second from the last dose, there was a slight increase. The ordinary constant acid content reappeared only after seven days from the last administration of the cereal decoction.

HORSES

1091 – **Stallion Service in the United States.** — WENTWORTH E. N., (Kansas Agricultural College), in *The Breeder's Gazette*, Vol. LXX, No. 5, p. 169. Chicago, August 3, 1916.

Of the twenty-two States which possess a government stallion service, nineteen have published the statistics respecting it, *i. e.*, New York, New Jersey, Pennsylvania, Michigan, Indiana, Illinois, Wisconsin, Iowa, Minnesota (1), North Dakota, South Dakota, Nebraska, Kansas, Utah, Montana, Idaho, Washington, Oregon and California. The report gives the distribution of the stallions amongst the different breeds, as shown in the following table :

| Breeds | Pure blood stallions | |
|---|---|---|
| | Number | Percentage |
| Percheron | 18 022 | 53.225 |
| Standardbred | 4 214 | 12.445 |
| Belgian | 4 091 | 12.082 |
| French, heavy | 2 116 | 6.249 |
| Shire | 2 104 | 6.214 |
| Clydesdale | 1 279 | 3.777 |
| German carriage horse | 502 | 1.483 |
| Shetland pony | 301 | 0.889 |
| Morgan | 296 | 0.874 |
| Hackney | 273 | 0.806 |
| English thoroughbred | 233 | 0.688 |
| French carriage-horse | 181 | 0.535 |
| American saddler | 120 | 0.355 |
| Suffolk | 60 | 0.177 |
| Cleveland Bay Trotters | 25 | 0.074 |
| Non Standard Trotters | 25 | 0.074 |
| Arab | 18 | 0.053 |

Obviously the heavy horses are in a large majority (81.72 per cent.), those of the light type only representing 18.28 per cent. Besides these 33 860 pure bred stallions, 23 151 grade stallions are authorised and approved for the stallion service. These represent only 38.05 per cent of the entire number of stallions employed.

1092 – **The Very Short Gestation of a Mare.** — DE CHOIN, in *Comptes rendus de l'Académie d'Agriculture de France*, Vol. 1, Year 1915, No. 25, pp. 716-717. Paris, 1916.

This note records observations on a mare, Walkyrie, which was served on March 19, 1915 and foaled on November 7, 1915, after only 232 days of pregnancy. The offspring, which was perfectly viable, weighed 128 lbs. and had a height to the withers of about 36 ins. The only appa

(1) See *B.* Sept. 1916, No. 993.

rent incomplete part at birth was the epidermis of the feet which grew rapidly during the first few days of the foal's life. This authoritative case considerably reduces the 287 days previously recorded as the minimum period of gestation for a mare.

1093 – **Origin of the Brazilian Breed of Cattle "Caracu".** — Romao J. J. in *O Criador Paulista*, 11th year, No. 7, pp. 179-184, 11 fig. Sao Paulo, July, 1916.

The "Caracu" breed was founded by the great-grandfather of the writer, Joaquim Bernardes de Costa Junquiera at Rio Verde (Minas Geraes) by crossing the cattle named "Junqueiros" in the State of Minas, "Franqueiros" in the State of Sao Paulo, and "Colonia" in that of Bahia, with the cattle "Curraleiro". At that time the "Junqueiro" and the "Curraleiro" constituted two distinct types. The breed "Junqueiro" was descended from the Portuguese "Alentejana" imported from Portugal into the southern part of the State of Minas, where it developed much more than in the country of its origin. The "Curraleiro" breed is of Spanish origin, the first examples imported into Matto Grosso and to Goyaz came from Uruguay and the Argentine. The cattle "Caracu" has been inbred and selected by three generations of cattle-breeders. It has been brought to a very high degree of perfection and constitutes to-day a constant and well defined type. According to the writer it would be expedient to breed it pure instead of crossing it with the zebu, as is almost universally done in the State of Minas Gereaes, for the offspring of the cross is much less satisfactory than the pure "Caracu".

1094 – **The Ration and Age of First Calving as Factors Influencing the Growth and Dairy Qualities of Cows.** — Eckles C. H. in *University of Missouri College of Agriculture Experiment Station, Bulletin* No. 135. Columbia, Missouri, September, 1915. CATTLE

This investigation was made to obtain data on two points (1) the influence of liberal as compared with light rations during the growing period, (2) the influence of the age at first calving. It was desired to ascertain more definitely the relation of these factors to the dairy qualities of the cow. The data obtained were also expected to have an important bearing on the relation of these factors to dairy type, rate of growth, age at maturity and date of sexual maturity.

A list of questions relating to these was sent to the most important breeders of dairy cows. Three hundred answers were received and have been tabulated. These indicate a wide range of opinion as regards such points as the relation of age at first calving to type, milking qualities and size, the effect of heavy grain feeding during the period of growth upon size, milking qualities and type.

The experiments lasted eight years and were made with forty pure-bred cows of the Jersey, Holstein and Ayrshire breeds. Complete records of the food they consumed and their development as shown by skeleton measurements and the weight, were kept from birth to maturity. The milk production was recorded for each cow during two or more periods of lactation.

The forty cows were divided into two principal groups. The first was

given a heavy ration from birth to first calving, the second a light ration. The heavy ration consisted of whole milk during the first six months, on an average 16 lbs. per head per day, and all the grain (corn two parts, oats one part) and hay the animals would consume up to the first calving. During the summer a number of these animals were kept grazing and received in addition the grain ration, others were not put on pasture but received the hay and grain all through the year. After calving all the cows had alfalfa, hay, silage and a grain mixture of four parts of corn, two of bran and one of oilmeal, administered proportionally to the milk production of the animal. The light fed group received the mother's milk during the first fortnight, this was then gradually replaced with skim milk, fed warm and sweet immediately after separation, until the end of six months. Alfalfa hay was given as soon as the animals would consume it. Grain was only given from the time when milk production commenced. In the summer a number of the animals was put on pasture, while the remainder received only hay and a little green soiling crops. After calving all the cows of the second group received the same ration as those of the first.

The factor of age at first calving was introduced by taking care that half the cows of each group calved at an early age for the breed, and the other half about a year later.

*Influence of ration upon rate of growth.* — The weight and skeleton measurements were determined every month. The effect of the heavy feeding was a more rapid development of the skeleton especially during the period when growth is most rapid. Later it produced a much greater fattening. The animals which were lightly fed grew less rapidly but for a longer time ; nevertheless they never attained a size equal to that of the first group. The difference between heavy feeding and light feeding for the young animals shows more strongly upon the weight than upon the rate of skeleton growth. One cause of the existence of small cows in commercial herds is the character of the ration during the growing period.

*Influence of the age at first calving on the size.* — This factor has a marked effect on the size of cows. Milk production imposes a heavy tax on the cow and checks the growth in a very decided way. On the other hand gestation does not sensibly hinder its development. The most important factors which tend to limit the size of cows are scanty feeding during the growing period and early breeding.

*Sexual maturity.* — The ration exercises a considerable influence on the time of sexual maturity. Animals fed heavily mature sexually when two to four months younger than animals fed lightly.

*Relation of ration to dairy qualities.* — The heifers heavily fed during growth were slightly inferior in milk production, to those fed lightly. The employment of heavy grain rations seems to have had some detrimental effect on the milking functions. But, within the limits ordinarily existing in practice, this factor probably has no appreciable influence. Some high-producing cows were found in each group, and also some medium and some inferior. The data indicate that the hereditary factors such as the influence

of the sire and the individuality of the animal are the real determining factors with reference to the milking functions of the cow. Inferior milk-producing cows are rather the fruit of heredity than of the treatment received when they were young.

*Age of calving and milk production.* — The experimental data given and a compilation of the records of the University of Missouri herd for twenty-two years show that on an average the maximum production of milk is secured from cows well matured before they commenced lactation. The maximum production among ninety-five cows was obtained from those calving between the ages of 28 and 32 months, the minimum from those calving under 20 months old.

*Relation of ration to dairy type.* — Heavy feeding of young cows tends to produce larger and rather coarser animals than does light feeding. At the time of calving the conformation of the animal bred on heavy grain ration is somewhat different from that of one bred on a ration of roughage. If both cows are given the same ration after calving, this difference soon disappears.

*Age of calving and dairy type.* — Early calving tends to produce a smaller and more refined type of cow than that which results from calving a year later.

*Relation of roughage fed to digestion.* — The opinion of breeders is that a cow bred principally on roughage has a greater capacity for the elaboration of the food when it reaches maturity. This opinion has not been confirmed by the writer's investigation. For a short time after calving there was a marked difference, but this disappeared gradually and two months later there was no difference between the two groups. It was proved that the animals of the two groups required the same quantity of nutrients to produce a pound of milk.

*Conclusion.* — It is possible to influence, to some extent, the rate of growth, the size when mature and the type of cows, by the liberality of the ration during the period of growth, and by the age at first calving. Even within limits of variation much wider than normal, the character of the ration, with reference to the amount of nutriment that it yields, has no appreciable effect on the milking functions of the cow when it has reached maturity.

The age at first calving is a factor of some importance with respect to the development of the milking functions of the cow. Calving at a very early age prejudices the best development of the milking function and nothing is gained by retarding it too much.

1095 – **The Cost of Food in the Production of Milk.** — CROWTHER Ch. and RUSTON A. G. in the *University of Leeds and Yorkshire Council for Agricultural Education Bulletin* No. 98, pp. 1-37. Leeds., 1915.

During the four years from April 1911 to March 1915, a continuous series of investigations on the cost of feeding cows, and the yield and quality of the milk produced by them has been carried out on a number of farms in the North Riding of Yorkshire.

The present report deals with the data obtained during the twelve

months from April 1, 1914 to March 31, 1915. As in previous years each herd has been visited fortnightly by the Recorder for the purpose of weighing, sampling and testing the morning and evening milk of each individual cow. At each visit he has ascertained also the amount and nature of the food consumed by the cows and has obtained from the farmer particulars as to the breed, age etc. of each cow. During the year 291 cows were tested, but for only 144 of these have complete records for the twelve months been obtained. The climatic conditions have a considerable influence both on the grazing and on the hay crop ; and therefore also on the cost of the food consumed ; accordingly the meteorological data for the five summer months are given. The great variations of temperature in May, and the unusually severe night frosts checked the growth of grass to such an extent that the pastures were bare until late in the sumer and the hay crop distinctly light.

The report deals first with yield of milk then with the nature and amount of feeding (including cost) and finally with the percentage of fat in the milk.

The data for 1914-1915 are compared with those of the preceding years, the cows being divided into eight classes according to their yield as follows :

TABLE I.

| | Number of cows giving milk yield (gallons) for 12 months | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 400 or less | 401–500 | 501–600 | 601–700 | 701–800 | 801–900 | 901–1000 | Over 1000 |
| 1914–1915 . . . . . | 13 | 19 | 19 | 30 | 24 | 19 | 11 | 9 |
| 1913–1914 . . . . . | 11 | 17 | 22 | 35 | 28 | 14 | 5 | 9 |
| 1912–1913 . . . . . | 7 | 14 | 22 | 25 | 19 | 11 | 7 | 4 |
| 1911–1912 . . . . . | 9 | 8 | 20 | 15 | 15 | 10 | 11 | 7 |
| Total 4 Years . . . | 40 | 58 | 83 | 105 | 86 | 54 | 34 | 28 |

Great differences are again noticeable between the average yields of the various herds and still more between the records of the individual cow within each herd. The maximum average yield per head was 935 gallons, the minimum 472 gallons.

The average weights of food consumed and the duration of the pasturage per head in 1914-1915 and 1913-14 were as follows :

Although the mean consumption per annum was almost the same in the two years, close examination of the figures given in the original shows that the system of feeding has differed greatly as between the various herds. In view of these differences the amount of digestible proteins, and the starch equivalent of the food actually fed per day were compared with the

TABLE II.

| | Grass | Hay | Straw | Roots | Cake and meal |
|---|---|---|---|---|---|
| | weeks | tons. cwt. st. | cwt. st. | tons. cwt. st. | cwt. st. |
| Average 1914–15. . . . . | 27 | 19 3 | 12 6 | 4 9 3 | 17 5 |
| » 1913–14. . . . . | 28 | 1 5 2 | 12 4 | 4 0 2 | 17 7 |

protein and starch required according to standard for the production of the milk obtained. The average amount of digestible protein fed was 1.98 lbs. per day, that required 2.04 lbs. ; the average starch equivalent of the food fed was 12.83 lbs., that required 11.64 lbs.

As in previous years the home grown foods were valued according to the following arbitrary scale.

| | | | |
|---|---|---|---|
| Hay | £2 15s per ton. | Swedes | 10s 0d per ton. |
| Oat Straw | £1 10s " | Mangels | 10s 6d " |
| Barley Straw | £1 5s " | Turnips | 8s 0d " |
| Grass | 3s 6d per week for spring calvers. | | |

These prices are probably on the whole, rather higher than the bare cost of production and represent what may be termed the feeding or consuming value. The purchased foods were taken at full cost without any deduction for the value of the manurial residues arising from the consumption.

The estimated average cost of feeding per cow per annum was as follows.

TABLE III.

| | Estimated cost per cow per annum | | | | | |
|---|---|---|---|---|---|---|
| | Grass | Hay | Straw | Roots | Cake etc. | Total |
| Average. . . . . | £4 15s 5d | £2 11s 4d | 17s 10d | £2 3s 11d | £5 6s 9d | £15 15s 3d |
| Per cent . . . . . | 30 | 16,5 | 5,5 | 14 | 34 | 100 |

There were considerable variations from the mean, the maximum cost of food per head being £ 20 10s and the minimum £ 13. The hay and grass represent on the average one-half, the arable crops one-fifth and the purchased foods one-third of the total cost, results in close agreement with those found in previous years.

Of the total number of cows 42 did not yield milk equivalent in value to the estimated cost of feeding when the milk was valued at 6d per gallon, 24 per cent when the value was 7d per gallon, 15 per cent when 8d per gallon, 10 per cent when 9d per gallon and 7 per cent when 10d per gallon.

Assuming that 100 gallons of whole milk give roughly 90 gallons of skim milk and valuing the latter at 2d per gallon, then deducting the value

of the skim milk from the full food bill of each animal, values were obtained for the cost of food per pound of butter fat produced. These values varied from a minimum of 5.5*d* to a maximum of 14.9*d* per pound with a mean of 9.4*d*.

The variations of the percentage of fat deserve special mention. The following table gives a summary of the data for 260 days.

TABLE IV.

| Number of samples of which the percentage of fat lies between | Morning milk | Evening milk | Average |
|---|---|---|---|
| 2,6 to 2,79 | 5 | 0 | 0 |
| 2,8 to 2,99 | 9 | 0 | 0 |
| 3,0 to 3,19 | 47 | 1 | 1 |
| 3,2 to 3,39 | 56 | 2 | 9 |
| 3,4 to 3,59 | 47 | 14 | 42 |
| 3,6 to 3,79 | 36 | 13 | 77 |
| 3,8 to 3,99 | 22 | 28 | 60 |
| 4,0 to 4,19 | 9 | 48 | 43 |
| 4,2 to 4,39 | 9 | 49 | 9 |
| 4,4 to 4,59 | 5 | 40 | 4 |
| 4,6 to 4,79 | 3 | 27 | 4 |
| 4,8 to 4,99 | 4 | 21 | 2 |
| 5,0 and above | 8 | 17 | 9 |

The considerable difference between the percentage of fat in the morning milk and the evening milk is due to the difference in the time elapsed since the preceding milking. The greater the difference between the day and night intervals, the greater is the difference in the mean fat content of the milk at the two milkings.

1096 – **Feeding Trials of Dairy Cows in Denmark.** — LUND, A V. in 89th *Compte rendu du Laboratoire d'essais de Copenhague* (comunicated to the International Institute of Agriculture by its Danish Correspondent. Baron ROSENKRANTZ).

A. *Trials with Mangels and Turnips.* — The trials were intended to compare the feeding value of mangels and turnips, and also the amount of dry matter of the kinds moderately rich in this constituent, *e. g.* mangels, Barres' Ovoid and Eckendorf; turnips, Bangholm and Superlative. The results of three groups (I, II, III) of experiments are given.

I. *Comparison of Mangels and Turnips Having the Same Content of Dry Matter.* — In each experimental farm two groups of uniform cows submitted to the same feeding during the preliminary period, were

chosen. During the trial period one of the groups received a certain amount of dry matter from mangels, the other a corresponding quantity from turnips; in the post period the two groups were fed in the same manner. In the trial period 79.8 lbs. of mangels (9.3 lbs. of dry matter) were on an average replaced by 84 lbs. of turnips (9.26 lbs. of dry matter). The group fed on mangels produced, during the trial period, a little more milk than that fed on turnips, whilst in the periods before and after the trial, when the two groups received the same diet, the milk production was the same. The mean increase of milk yield for ten cows was 7.27 lbs. per day, or about 2.5 per cent. On the other hand, the percentage of fat in the milk, which in the preparatory period was equal in the two groups, diminished slightly during the trial period in the milk from the group fed on mangels, but increased again in the post period. This was only a matter of some hundredths of one per cent, so it is not easy to determine what significance should be attached to the difference. The change of diet had no influence on the composition of the milk or on the general condition of the different groups.

II. *Comparison of Roots (mangels and turnips) Having a Comparatively High Content of Dry Matter.* — The trials were made as described above. The different roots contained the following amounts of dry matter :

| Mangels | Mean content per cent | Maximum content per cent | Minimum content per cent |
|---|---|---|---|
| . . . . . | 13. 4 | 14.39 | 11.43 |
| Barres' Ovoid . . . . . | 12.40 | 13.67 | 9.42 |
| Eckendorf . . . . . | 9.97 | 10.97 | 8.12 |
| *Turnips :* | | | |
| Bangholm . . . . . | 11.52 | 12.27 | 10.56 |
| Superlative . . . . . | 9.57 | 9.80 | 9.16 |

The animals were given on an average 8.5 lbs. of dry matter per head per day ; for this purpose 70.3 lbs of the roots having a high content of dry matter, and 74.6 lbs of the roots having a low content, were required. The nett result showed that the difference in feeding affected neither the quantity of milk, nor its composition, nor the general condition of the animal. In other words, a difference in the content of dry matter produced no difference in the forage value of the roots.

III. *Influence of the Roots on the Quality of the Butter* — An experiment made in a farm with two very comparable groups of cows containing sixteen in each. During a sufficient preparatory period both groups received the same ration (half mangel, half turnip). The milk from each group during several consecutive days was dispatched to a dairy where the cream was skimmed, acidified and transformed into butter under identical conditions for the two groups. Then in the trial, the feeding was modified so that the first group received 99.2 lbs. of turnips per cow, the second group 88.2 lbs. of mangels (giving an equal amount of dry matter). At the end

of ten days a second preparation of butter similar to the first was made, and a third eighteen days later.

During the period after the trial, the two groups received the same quantity of mangels, 88.2 lbs per head per day. Ten days later a fresh preparation of butter was made. In each case the butter was conveyed to the laboratory to be examined and judged. The butter of the two groups was found to be of the same quality, but that from the feeding with turnips had a higher iodine number and olein content than had that from the feeding with mangels. Further the former butter contained one per cent more water, and the butter milk 0.18 per cent more fat. However the treatment of the cream and butter explains these differences.

B *Trials withc Cocoa Cake.* — This by-product from the manufacture of cocoa, although only recently used in Denmark for the feeding of dairy cows, has quickly acquired the reputation of increasing the percentage of fat in milk.

The experiments lasted more than three years and were made on two groups of very comparable cows, one group being permanently fed on cocoa cake.

In the first year when the earth nut and soja cake (1.75 lbs. added to the ration) fed to the first group, was replaced by 2.42 lbs. of cocoa cake, the quantity of milk diminished, but the percentage of butter-fat did not increase so as to equal that of the second (permanently cocoa fed) group. In the second year an attempt was made to ascertain the influence of the addition of 1.54 lbs. of cocoa cake, particularly as to whether the milk yield was maintained and at the same time the percentage or butter increased. But the cocoa fed group in spite of the addition of cake to its ration, gave less milk than did the other group, although this contained a little more butterfat (0.15 per cent) so that the cows of the two groups produced almost the same absolute amount of butter-fat. Just as in the preceding trial, the milk from the cocoa fed group proved to be richer in protein but poorer in sugar and ash. A similar trial made in the third year gave concordant results. Thus the principal result is an increase in the percentage of butter-fat in the milk but simultaneously a decrease in the yield of milk, so that the absolute quantity of butter-fat does not increase, even as a result of the supplementary addition of cocoa cake. Since the latter moreover modifies the composition of the milk it mus be considered rather as a poison than a food, and not given to dairy cows. These results are corroborated by the data below.

C. *Poisoning by Thebromiue Due to Cocoa Cake.* – Professor G. H. HANSEN deals with the chemical composition of this cake and describes it as containing an amount of theobromine approximately equivalent chemically and pharmacologically to the caffeine contained in coffee an tea. Cocoa beans are richer in theobromine (1 to 2 per cent) than are the shells (0.5 to 0.8 per cent) which form the greater part of the food. However the shells may also contain much theobromine as is indicated by the following data.

Professor HANSEN publishes the evidence of several veterinary sur-

geons who have made reports on the subject of poisoning by cocoa cake, which contained about 1.5 per cent of theobromine. Cases of poisoning were recorded both with cattle, where the effect initially took the form of an eczema, and with pigs and fowls where death resulted in several cases. Professor HANSEN made several laboratory experiments both with the cake and with theobromine, on fowls, rabbits and mice to determine their action on the organism. These led to the conclusion, that owing to its poisonous character, cocoa cake cannot be considered as a food.

1097 - **Comparative Experiments on the Feeding of Cows with Cotton cake and Palm kernel Cake.** — *Farmer and Stockbreeder and Chamber of Agriculture Journal.* Vol. XXIX New Series, No. 1403, pp. 1323-1324. London, August 14, 1916.

The Governors of the Cumberland and Westmoreland Farm School at Newton Rigg near Penrith, in their annual report, give the following particulars of experiments on the feeding of cows on cotton cake and palm kernel cake.

The dissimilarity in the composition of Egyptian undecorticated cotton cake and palm kernel cake makes it impossible to devise two rations of similar nuritive value with the same weight of each cake in the respective rations. The following were the daily rations.

| Ration I | Ration II |
|---|---|
| 35 lbs swedes. | 35 lbs swedes. |
| 8 lbs hay. | 8 lbs hay. |
| 14 lbs oat straw. | 14 lbs oat straw. |
| 2 3/4 lbs decorticated cotton cake | 2 3/4 lbs decorticated cotton cake. |
| 4 lbs Egyptian undecorticated cotton cake | 5 lbs of palmnut kernel cake. |
| 2 lbs crushed oats. | |

The two rations contain almost the same quantity of digestible matter, the albuminoid ratios being 1 :7 in the first and 1 : 7.5 in the second. Owing to the difference in the cost of the cakes at the time, ration No. 1 cost 13 *d* per week more than ration No. 2.

The experiments were made on eight cows divided into two lots, which received the respective rations I and II for three weeks. The rations were then reversed and at the end of three weeks were again reversed and again at the end of another three weeks, the trial thus lasting twelve weeks. The cows were weighed at the commencement and at the end of each period of three weeks. The milk of each cows was weighed morning and evening and the fat of the mixed morning and evening milk of each lot estimated twice under each diet.

The following is a summary of the results :

| | Ration I Cotton cake | Ration II Palm nut cake |
|---|---|---|
| Total quantity of milk produced . . . . . | 7749 lbs. | 8157 lbs. |
| Gain of cows in live weight . . . . . | 392 lbs. | 394 lbs. |
| Percentage of fat in the milk . . . . . | 3.55 | 3.60 |

Thus the Egyptian cotton cake while costing more than the palmnut kernel cake produced less milk without increasing the gain in live weight of the cows or the percentage of fat in the milk. It should be stated that the cows do not take readily to palmnut kernel cake unless it is damp with treacle solution or dusted with locust bean meal.

1098 – **Studies on the Hygienic Production of Milk: Importance and Control of the Microflora of the Udder in the Selection of Dairy Cows.** — GORINI, COSTANTINO, in *Reale Instituto Lombardo di Scienze e Lettere*, Rendiconti, Vol. XLIX, part. 14, pp. 480-489 Milan, June 22, 1916.

The writer's previous investigations carried out since 1901 have established the following facts : 1) the microflora of the udder is characteristic and composed of acid-forming bacteria ; 2) with these bacteria the coccus forms predominate, particularly the micrococcus (*Bacillus minimus mammae*) but bacillus forms are also met with ; 3) the microflora assists both the digestion of the milk and the ripening of the cheese, by its peptonising action on the casein ; 4) in some cases the microflora of the udder contains the common lactic organisms, principally of the streptococcus type ; 5) sometimes, although originating in a healthy udder, it exercises a harmful action on the milk.

Subsequent investigations made in the Bacteriological Laboratory of the Agricultural High School of Milan, confirm the above results and lead also to the following conclusions.

1) The importance of the microflora of the udder increases as milking approaches the ideal condition of asepsis, *i. e.* the absence of external microbial contamination.

2) The micro-organisms of the udder are most often found grouped in albuminous clots, which not only makes their enumeration difficult, but also gives them a marked power to resist heat, although they are not sporulating.

3) The microflora of the udder is not affected by the hygienic condition of the cow-sheds, and for this reason bacterial counts of milk may not give a true indication of the cleanliness of the milking process.

4) The microflora of the udder seems to be connected with external and internal factors which still require to be investigated. With certain cows the quantitative and qualitative examination yield such persistently high results, that the condition may almost be described as abnormal though not pathological.

The writer proposes that in the selection of heifers for the production of milk, not only their state of health but also the microflora of their udders should be taken into account. Such selection is particularly necessary in the case of the so-called " sanitary milks ", milked by aseptic methods and intended, both in the raw and pasteurised or sterilised condition, for the feeding of infants and invalids.

The method of examining the microflora is described by the writer. Ordinary methods of culture on artificial media cannot be employed, but the fermentation test or lactozymoscopic test is used ; the latter must be

carefully standardised and should be applied to the milk obtained aseptically from each cow and from each quarter.

A bibliography of twenty-three publications is appended.

1099 – **The East Anglian Milk Recording Society** (1). — CHEVALIER, J. B. and OLDERSHAW, A. W. in *Journal of the Board of Agriculture*, Vol. XXIII, No. 5, pp. 431 to 436, London, August, 1916.

The East Anglian Milk Recording Society was established in June 1914. The annual subscription was fixed at 2*s* 6*d* per member in addition to a levy of 2*s* per cow per annum — the minimum levy being fixed at £ 1 per member. The members of the Society were scattered over a very wide area, within a radius of about thirty miles of Ipswich. The milk recorder paid a surprise visit to each herd at least once in every six weeks. He received a salary of £ 100 per annum and paid his own travelling expenses. Samples of the mixed milk of the herds were taken on each evening and morning of the recorder's visit: these samples were tested gratuitously but a fee of 3*d* per sample was charged for any addition samples tested. The Society comprises 21 members with 25 herds, divided into two classes, herds containing cows of a mixed type, and herds of pure bred cattle. At the first series of visits of the recorder 695 cows were tested.

One of the most useful functions of the Society consists of carefully weighing the food fed to the cows of various members. The results of investigations as to rations have been communicated to the local press from time to time, and it is hoped that in this manner, the Society in addition to helping members to select their cows and feed them cheaply, will also be of some use to all owners of milking herds in the neighbourhood.

The following table gives the principal returns collected by the recorder for the year June 28, 1914 to June 27, 1915.

| | | Number of cows |
|---|---|---|
| *Total number* | | 566 |
| *Breeds*: | Shorthorn | 32 |
| | Red Poll | 99 |
| | Jersey | 35 |
| | British Holstein | 66 |
| | Crossbred | 31 |
| | Undescribed | 303 |
| *Age*: | One calf of three years old | 61 |
| | Four calves of six years old | 132 |
| | Aged animals | 62 |
| | Undescribed | 311 |

(1) See *B.* March 1916, Nos. 322 and 337. (*Ed.*)

| | Number of cows |
|---|---|
| *Cows giving per annum* | |
| 10 000 lbs of milk | 13 |
| 8 000 " " " | 56 |
| 6 000 " " " | 155 |
| 4 000 " " " | 191 |
| Under 4000 lbs of milk | 97 |
| Incomplete | 54 |
| *Butter fat average* | |
| Evening milk | 4.2 per cent |
| Morning milk | 3.6 per cent |

A milk recording Society may be of value to dairy farmers :

1) By enabling them to eliminate unprofitable cows from their herds.

2) By providing a government certificate of milk yield, and in this way enabling purchasers of cows (or young stock from the herd) to place absolute confidence in the accuracy of the records given.

3) By enabling the farmer to have samples of his milk taken and tested at frequent intervals, so that he may know when it is in danger of falling below the standard.

4) The account kept of the rations fed allows of a comparison between them and their cost in different herds and so enables farmers to judge for themselves as to the cheapest feeding for milk production in the case of their own stock.

1100 – **The Dairy Side of the Ayrshire.** — WINSLOW, C. M., in *The Field*, Vol. XXVI, No. 7, p. 588. New York, July 1916.

The ever-increasing interest in blooded dairy stock is very largely due to Advanced Registry Testing done by the four leading breeds. It has brought the good cows to the front, eradicated the scrub cow when practised, and has led to the investment of large sums of money in the dairy industry.

Testing has given to the public a knowledge of the real value of high-class dairy cows, and has revolutionised the whole dairy industry of the United States. The Ayrshire breed has perhaps benefited more than all the others. The long-held belief that the Ayrshire is a wonderful dairy cow has been converted from a supposition to an absolute fact. The perfection of its conformation has never been questioned, but testing has shown that this conformation is correlated with high production, that the breed can produce a record better than 25 000 pounds of milk and 1 000 lbs of butter.

Official milk records of four cows a full year taken in connection with carefully kept feeding records made by the owners, are given in the following tables. The method of feeding employed by the breeders not only reveals the benefit gained by the cows, but also affords a valuable object lesson to others having cows on test.

## Two-Year-Old Record.

### CASTLEMAINS NANCY 4TH, 28 520.

Bred and owned by Percival Roberts, Jr. Penshurst Farm, Narberth, Pa. Born October 10, 1910. Weight 1015 lbs.

| 1913 | Milk lbs. | Fat lbs. | Total lbs. butter for the year. | Average per cent fat for the year |
|---|---|---|---|---|
| August | 1 327.3 | 46.32 | | |
| September | 1 205.9 | 37.97 | | |
| October | 1 276 | 45.55 | | |
| November | 1 897,4 | 40.47 | | |
| December | 1 149.7 | 42.77 | | |
| **1914** | | | | |
| January | 1 134.5 | 40.62 | | |
| February | 1 107,6 | 41.42 | | |
| March | 1 232.7 | 51.65 | | |
| April | 1 206.4 | 48.62 | | |
| May | 1 236.9 | 49.72 | | |
| June | 1 193.8 | 50.62 | | |
| July | 1 226.6 | 51.30 | | |
| 365 days | 14 494.08 | 547.03 | 644 | 3,78 % |

6 812 1/2 quarts milk, at 6c. per quart, . . . . . $ 498.75.

*Food consumed, with cost of same.*

| Lbs. | | Cost. |
|---|---|---|
| | | $ |
| 880 | Bran, at $26.00 per ton | 11.54 |
| 1 130 | Schumacher Stock Feed, at $28.10 per ton | 15.87 |
| 751 | Corn Meal, at $28.10 per ton | 10.70 |
| 901 1/2 | Oil Meal, at $31.50 per ton | 14.20 |
| 413 | Cotton Seed Meal, at $31.00 per ton | 6.40 |
| 760 | Beet Pulp, at $26.00 per ton | 9.88 |
| 8 500 | Silage, at $3.00 per ton | 12.75 |
| 1 819 | Hay, at $15,00 per ton | 13.64 |
| 9 236 | Beets, at $6.00 per ton | 27.71 |
| | Green Forage Crops | 8.32 |
| | | $ 131.01 |

Profit for the year, $277.74

## Three-Year-Old Record.

### Mc ALISTER'S BETTY, 23548.

Bred and owned by Percival Roberts, Jr., Penshurst Farm, Narberth, Pa.

| 1910-1911 | Milk lbs. | Fat per cent. | Fat lbs. | Butter lbs. |
|---|---|---|---|---|
| April | 373.1 | 5.4 % | 20.15 | 23.51 |
| May | 1 463.1 | 4,377 | 64.04 | 74.71 |
| June | 1 493.1 | 3,86 | 57.63 | 67.23 |
| July | 1 454 | 3,657 | 53.17 | 62.04 |
| August | 1 351.1 | 3,61 | 48.77 | 56.90 |
| September | 1 104.5 | 3,8 | 41.07 | 48.96 |
| October | 1 048.2 | 4,407 | 46.19 | 53.89 |
| November | 999.6 | 4,16 | 41.58 | 48.51 |
| December | 1 123.6 | 4,33 | 48.65 | 56.76 |
| January | 1 121.5 | 4,11 | 46.09 | 53.77 |
| February | 985.7 | 3,97 | 39.13 | 45.65 |
| March | 1 067 | 4,38 | 46.73 | 54.52 |
| April | 623.5 | 4,38 | 27.31 | 31.85 |
| Totals | 14 298.0 | 4,19 % (Mean) | 581.41 | 678.31 |

6 604 quart of milk, at 5 cents per quart . . . . . $330.20

*Food consumed with cost of same.*

| Lbs. | | Cost. |
|---|---|---|
| | | £ |
| 943.5 | Bran, at $25 per ton | 11.7937 |
| 875 | Ground Oats, at $38 per ton | 16.625 |
| 276.5 | Corn Meal, at $28 per ton | 3.8701 |
| 906.5 | Gluten Feed, at $32 per ton | 14.504 |
| 224.5 | Cotton Seed Meal, at $32 per ton | 3.592 |
| 33.5 | Oil Meal, at $36 per ton | 0.603 |
| 1 300 | Alfalfa Hay, at $22 per ton | 14.30 |
| 2 000 | Mixed Hay, at $18 per ton | 18.00 |
| 5 000 | Ensilage, at $3 per ton | 15.00 |
| 5 000 | Mangels, at $8 | 40.00 |
| | Six Month's Pasture, at $3 per month | 18.00 |
| | | $138.28 |

Profit for the year $198.12.

## Four-Year-Old Record.

### August Lassie, 29581

Bred by L. A. Reymann. Owned by L. A. Reymann Estate, Wheeling, W. Va.

| | Milk lbs. | Fat per cent. | Fat lbs. | Butter lbs. |
|---|---|---|---|---|
| March, 18 days | 816.6 | 3,69 % | 30.13 | 35.45 |
| April | 1 898.3 | 3,69 | 70,05 | 82.41 |
| May | 2 146.7 | 3,85 | 82,65 | 97.23 |
| June | 1 898.4 | 3,87 | 73.47 | 86.43 |
| July | 1 716.3 | 4,14 | 71.05 | 83.59 |
| August | 1 544.5 | 4,12 | 63.63 | 74.86 |
| September | 1 392.9 | 4,38 | 61.01 | 71,78 |
| October | 1 371.1 | 4,12 | 56.49 | 66.46 |
| November | 1 235.9 | 4,28 | 52 94 | 62.28 |
| December | 1 261.4 | 4,06 | 51.21 | 60.25 |
| January | 1 164.1 | 4,23 | 49.24 | 57.94 |
| February | 984.7 | 4,35 | 42.84 | 50.39 |
| March, 12 days | 352.5 | 4,35 | 15.33 | 18.04 |
| Totals 365 days | 17 784.4 | 4,05 % (Mean) | 726.03 | 847.11 |

8 272 quarts of milk, at 7 1/2 cents per quart . . . . . $ 620.40

### *Food consumed with cost of same.*

| Lbs. | | Cost. |
|---|---|---|
| | | $ |
| 1 095 | Bran, at $24 per ton | 13.14 |
| 1 460 | Ground Oats, at $25 per ton | 18.25 |
| 730 | Oil Meal, at $40 per ton | 14.60 |
| 1 460 | Dis. Dr. Gr., at $33 per ton | 24.09 |
| 1 095 | Purina, at $30 per ton | 16.42 |
| 840 | Corn, at $30 per ton | 12.60 |
| 2 920 | Beet Pulp, at $24 per ton | 35.04 |
| 9 125 | Silage, at $4 per ton | 18.25 |
| 2 555 | Alfalfa, at $20 per ton | 25.55 |
| 1 095 | Clover, at $15 per ton | 8.21 |
| | | $186.15 |

Profit for the year $434.25.

## Mature Record.

### Garclaugh May Mischieff 27944.

Imported and owned by Percival Roberts, Jr,. Penshurst Farm, Narberth, Pa.

| | Milk lbs. | Fat per cent. | Fat lbs. | Butter lbs. |
|---|---|---|---|---|
| December, 5 days | 242.9 | 3,2 % | 7.77 | 9,14 |
| January | 2 067.5 | 3,2 | 66,16 | 77.84 |
| February | 2 348.7 | 3,05 | 71,63 | 84.27 |
| March | 2 646.8 | 2,94 | 77.82 | 91.55 |
| April | 2 431.7 | 3,81 | 92.65 | 109 |
| May | 2 636.3 | 3,23 | 85.15 | 100.18 |
| June | 2 492.7 | 3,47 | 86.5 | 101.76 |
| July | 2 445.9 | 3,77 | 92.21 | 108.48 |
| August | 2 004.3 | 3,79 | 75.96 | 89.36 |
| September | 1 562.6 | 4,07 | 63.6 | 74.82 |
| October | 1 610.3 | 3,93 | 63.28 | 74.45 |
| November | 1 532.9 | 4,03 | 61.84 | 72.75 |
| December, 26 days | 1 306.1 | 3,85 | 50.34 | 59.22 |
| Totals, 356 days | 25 328.7 | 3,53 % (Mean) | 894.91 | 1 052.83 |

*Food consumed, and cost of same.*

| Lbs. | | Cost. |
|---|---|---|
| | | $ |
| 961 | Bran, at $24 per ton | 11.53 |
| 1 013 | Schumacher Stock Feed, at $30.80 per ton | 15 60 |
| 767 | Hominy, at $29.20 per ton | 11.20 |
| 837 | Linseed Oil Meal, at $37.40 per ton | 15.65 |
| 1 066 | Cotton Seed Meal, at $29 per ton | 15,46 |
| 149 | Gluten, at $25.40 per ton | 1.89 |
| 153 | Ajax, at $33.80 per ton | 2.59 |
| 668 | Beet Pulp, at $26 per ton | 8.69 |
| 11 200 | Corn Silage, at $3 per ton | 16.87 |
| 22 233 | Beets, at $4 per ton | 44.47 |
| 1 874 | Alfalfa Hay, at $24 per ton | 22.49 |
| 906 | Mixed Hay, at $15 per ton | 6.80 |
| | Green Feed | 4.23 |
| | | $177.46 |
| 11 780 | quarts of milk at 6 cents per quart | 706.80 |
| | Profit for the year | $529.34 |

1101 – **Sheep-raising in La Mancha, Spain : Systems of Stock-breeding Combined With Cultivation.** — SOROA, J. U., in *La Industria Pecuaria*, 17th year, No. 526, pp. 717-719. Madrid, August 20, 1916. SHEEP

In La Mancha, the farms usually combine the cultivation of 170 to 250 acres of arable land with a head of stock consisting of 200 to 300 sheep for wool, about 30 pigs and 6 to 8 or 10 mules.

*Rotation of Crops.* — Until a few years ago little but extensive cultivation was practised. The land was divided into three parts according to the system named " al tercio ", one remained fallow and on the other two cereals were grown. Now, owing to the work of the Agricultural Advisers, cultivation has become more and more intensive. The systems of rotation commonly employed are as follows.

A. — Vetches turned in, barley, beans, wheat. This rotation has been adopted in the Daimiel, on fresh lands in fairly good condition.

B. — Green fallow, cereal, a leguminous crop, cereal. This rotation is becoming general, and excellent results are expected from it, provided that the manure applied is well rotted. The following rotation is also sometimes practised: green peas (always in the spring), barley, lentils or vetches, wheat or oats.

C. — Rotation for irrigated land :, pearl millet (" panizo negro ", *i. e. Pennisetum typhoideum*), potatoes, beans, wheat. Practised in the municipalities of Manzanares., Daimiel and Villarrubia.

D. — The " al tercio " system, mentioned above, is the one most often employed.

*Pastures.* — Once every seven years barley or oats are generally sown in low forest to provide grazing for sheep. Breeding mules and sheep are also grazed on the lowland and plain pastures in the spring and autumn (Municipalities of Alcazar, Valle de Alcudia and those of the province of Toledo which belong to La Mancha) ; but in the Municipality of Malagón these pastures are intermixed with orchards of pear trees, plum trees and apricots, whilst in the province of Cuenca they are planted with alders, ash trees and sometimes willows.

*Manures.* — Both dung and fertilisers are used, the latter in large quantities for cereals. Dung is not abundant, on account of the limited number of animals, and moreover it is of bad quality because there are no well-built manure sheds. Sheep are folded on the land.

The artificial fertilisers consist of superphosphates and various mixtures whose composition is not stated. The price of dung is very high, £3 5*s* per ton without the cost of transport. The manurial value of folding is estimated at 5*d* for 100 sheep passing one night on the land, which provide sufficient manure for 175 to 240 square yards,

*Utilisation of the Products of the Trees.* — At the present time scarcely any use is made of the acacias and the few mulberry trees that exist; they afford little else but their shade. As the climate is not adapted for rearing silkworms, the mulberry leaves cannot be employed for this purpose and there are not enough of them for export. On the other hand the State Nurseries each year export an incresing number of acacias.

*Disadvantages Observed.* — 1) In breeding no scientific rule or definite method is followed, consequently a poor class of animal is the rule.

2) Fodder is scarce and in some seasons absolutely wanting.

3) The excessive travelling of the animals reduces their weight and production of milk.

In the region of La Mancha, sheep are bred under the two following system :

*Case* 1. — During the winter the ewes which have just lambed are given extra food, and when the lambs are weaned these are also fed until the time when the pastures are ready. For this purpose each ration costs more than 1.4*d* per day. The following account is given.

*Receipts.*

| | s | d |
|---|---|---|
| Production of milk for 2 ½ months after weaning | | |
| the lamb : 4.84 gallons at 13.1*d* per gallon | 5 | 3.3 |
| 5.5 lbs. of wool at 6.3*d* per lb. | 2 | 10.8 |
| 11.8 cwt. manure at 4.9*d* per cwt. | 4 | 9.8 |
| Value of the lamb | 11 | 2.4 |
| Total . . . £1 | 4 | 2.3 |

*Expenses.*

| | s | d |
|---|---|---|
| 90 days feeding the ewe, valuing the ration | | |
| at only 1.4*d* (the most favourable case) | 10 | 9.6 |
| 20 rations for the lamb at 0.8*d* per head per day | | 9.6 |
| Cost of keep during remainder of the year | 6 | 7.2 |
| Attendance at 0.11*d* per day. | 3 | 6.05 |
| Interest and depreciation at 0.019*d* per day, mortality risk at 4 per cent and cost of veterinary surgeon. | 2 | 4.8 |
| Total . . . £1 | 4 | 1.25 |

Thus the conclusion is drawn that the annual profit does not exceed 1.05 *d* per head.

*Case* 2 — Rearing being impossible, the lanbs are sold directly ; they are bought by middlemen at a low price, and it must be acknowledged that the loss on the side of the lambs is balanced by the gain in the production of milk, so that the nett result is the same as in the preceding case.

*Conclusion.* — From the above it is concluded that the best method of sheep-raising is to select the breed of La Mancha and cross it so as to obtain animals which can be weaned promptly and employed in the production of cheese. The latter substance keeps for a longer time than does milk or mutton, and the profit is not lowered by the demands of middlemen. Then cheap fodder must be found for the winter ; the rations should not cost more than 0.7*d* per head per day. Where this is not possible, improved breeds of great hardiness must be obtained for crossing with the breed of La Mancha, so as to resist the adverse conditions in times of a shortage of food.

1102 – **The Poland-China Breed of American Pigs.** — Standard Poland-China Record Association in *Freeman's Farmer*, Vol. LXX, No. 3, p. 15. North Yakima, Washington, March 1916.

The Poland-China breed originated in the Miami Valley, Butler County Ohio, at the beginning of the nineteenth century. Up to 1816 the Miami Valley contained two breeds of swine, the Russian or Russia and the Byfield. In 1815, the Society of Shakers introduced a boar and three brood sows known by the name of " Big China ", which were crossed with the Russians and the Byfields. The production of a breed called the " Warren County " pig, was the result. The name " Poland-China " was given to this breed at about 1860, although it had not been clearly shown that pigs of the Polish breed had entered into its formation.

The Poland-China is coarse, hardy, prolific and much larger than the other ordinary breeds. It has a broad body, strong shoulders, short legs, head and shoulders well squared, pendulous ears, short head and eyes wide part. This breed is now considered the best, being the typical one for the production of lard and obtaining the best prices in the market. The Western farmer is accustomed to graze his pigs in the summer and the Poland-China is well adapted to this practice. It attains a very high weight, 880 to 1100 lbs for boars, 550 to 850 lbs. for sows or sometimes even more. Its prolific character is indicated by the evidence of about 100 breeders, which shows that each litter contains on an average 9.75 young. Litters of fifteen have been observed. Moreover the Poland-China is one of the most long-lived breeds ; the case is cited of a sow living for eleven years, during which time she had nineteen litters and a total of 189 descendants.

1103 – **Ration Experiments with Swine.** — Faville, A. D., in *University of Wyoming Agricultural Experiment Station, Bulletin* No. 107, pp. 15-27. Laramie, Wyoming, September 1915.

*Pea Pasture* (1) *for Fattening Pigs. Comparison of hurdled and non-hurdled Pasture.* — For this experiment there were employed twenty one thrifty shoats divided into three groups of seven each group containing both pure-bred and grade Duroc-Jerseys of which the latter were three fourths Duroc and one fourth Tamworth. The supplementary ration was a mixture of one part of grain middlings with two parts of corn meal. In the course of the experiment, which lasted 112 days, each of the first two groups received 272 lbs of this ration and the third group 544 lbs. The peas for group I were hurdled off so that the pigs had access to fresh vines at short intervals. Group II was given the run of its entire field. Each of these two groups had at its disposal 1.47 acres of pasture. The third group was not put on pasture. The results of the experiment are given in Table I. They show that 365 lbs. or approximately 59 per cent less grain was required for 1000 lbs. gain when pea pasture, hurdled, replaced half the grain ration, and the saving was 313 lbs. or 51 per cent when

(1) See *B.* September 1916, No. 982.

the pasture was not hurdled. Comparison of the two groups proves that 52 lbs or approximately 17 per cent less grain was required for 100 lbs gain when the pea pasture was hurdled. One acre of hurdled pasture saved 1897 lbs. of grain, whilst one acre of the pasture not hurdled saved 1340 lbs. At the close of the pasture experiment Groups I and II were brought in and placed on a full grain ration, similar to the mixture they had been receiving, for 56 days. The results will be found in Table II. It will be seen at once that both pasture groups made considerably better gains than did Group III which had been fed on dry feed continuously. This more rapid development and the lesser consumption of grain for 100 lbs. gain should be credited to the residual effect of the pasture. Therefore taking the two experimental periods together, one acre of pasture, hurdled, saved 2086 lbs of grain, and one acre of pasture not hurdled saved 1568 lbs of grain, compared with an exclusivel ygrain feeding. Thus pea pasture is certainly a valuable aid in the production of cheap pork.

Comparison of the pure-bred and grade animals in the different groups shows that their gains of live weight were practically equal.

TABLE I. — *Pea Pasture, hurdled or not hurdled, for Pigs.*

| Group | Average initial live weight | Average final live weight | Averngе daily gain | Grain consumed for 100 lbs. gain | | |
|---|---|---|---|---|---|---|
| | | | | Corn | Middlings | Total |
| | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. |
| I | 65 | 174 | 0.97 | 167 | 83 | 250 |
| II | 67.3 | 157.3 | 0.80 | 201 | 101 | 302 |
| III | 68.4 | 156.9 | 0.79 | 410 | 205 | 615 |

TABLE II. — *Residual Effect of Pea Pasture for Fattening Pigs.*

| Group | Average daily gain per pig. | Average daily grain per pig. | Grain for 100 lbs. gain |
|---|---|---|---|
| | lbs. | lbs. | lbs. |
| I | 1.37 | 6.75 | 494 |
| II | 1.28 | 6.13 | 479 |
| III | 1.04 | 5.66 | 546 |

*Alfalfa Tea for growing pigs.* — A feeding experiment lasting 168 days was made on two groups of pigs, of four each. The grain ration consisted of equal parts of corn meal and middlings and of this mixture 3.3 lbs. were given per head per day both to the first group and to the second. For Group I this ration was mixed with water before feeding, whilst for Group II the

water was replaced by alfalfa tea, prepared by macerating 3 lbs. of alfalfa meal with 20 lbs of cold water allowing to stand from one feeding period to the next and then filtering through two thicknesses of cheese cloth. The tea had the following percentage composition, water 98, ash 0.56, crude protein 0.46, crude fibre 0.02, nitrogen-free extract 0.96, ether extract traces. The results given in Table III show that for 100 lbs. gain approximately 14 per cent less grain was required when alfalfa tea was used in the ration (Group II), but it is not certain that the employment of a small amount of alfalfa meal in place of the tea would not have proved equally adavantageous.

TABLE III. — *Alfalfa tea for growing pigs.*

| Group | Average initial live weight | Average final live weight | Average daily gain | Orain consumed for 100 lbs. gain | | |
|---|---|---|---|---|---|---|
| | | | | Corn | Middlings | Total |
| | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. |
| I | 36.8 | 135.0 | 0.58 | 278.5 | 278.5 | 557 |
| II | 37.3 | 151.8 | 0.68 | 239 | 239 | 478 |

*Comparison of corn meal and barley meal for fattening pigs.* — At the close of the experiment with alfalfa tea the eight pigs used were divided into two groups in such a way that each of the new groups contained two of the animals from each of the old groups. The pigs of Group I had an average weight of 146.8 lbs, those of Goup II 140 lbs. For 56 days Group I was fed with a mixture of four parts of corn meal with one part of alfalfa meal, Group II with a mixture of four parts of barley meal and one part alfalfa meal. Both the increase of live weight and the weight of food consumed per 100 lbs. gain were practically equal in the two groups, and the conclusion was drawn that barley-meal was as satisfactory a pig feed as corn meal.

*Comparison of pea hay and alfalfa hay for brood sows* — Two groups, each containing three brood sows were fed for 91 days with a mixture of two parts of corn meal and one part of middlings (3.6 lbs per head per day). In addition Group I was given 1.9 lbs of alfalfa hay, and Group II, 1.9 lbs. of pea hay per day. The results given in Table IV show alfalfa hay was somewhat the better.

TABLE IV. — *Comparison of pea hay and alfalfa hay for brood sows.*

| Group | Average initial live weight | Average final live weight | Average daily gain |
|---|---|---|---|
| | lbs. | lbs. | lbs. |
| I | 254 | 303 | 0.54 |
| II | 270 | 309 | 0.43 |

*Value of alfalfa hay in fattening rations for broods sows.* — Of the five animals available for the work, Group I containing two, received corn meal, Group II, containing three, was given a ration composed of four parts of corn meal and one part of alfalfa meal. The experiment lasted 42 days. The two groups fattened rapidily, Group I gaining 2.9 lbs. per head per day, Group II 2.1 lbs per head per day. The first group consumed 410 lbs. of corn meal, the second 389 lbs. corn meal and 97 lbs. of alfalfa hay per 100 lbs. gain.

1104 – **The Fattening of Pigs on Pasture under Forest.** — RAUSER, in *Mitteilungen der Vereinigun deutscher Schweinezüchter*, 23rd year, No. 16, pp. 185-187. Berlin, August 15, 1916.

In order to ascertain whether in time of shortage of food, pigs could be economically fattened in the forest, 30 hardy animals having a long snout and a good frame, which were accustomed to grazing, were purchased for this purpose. The forest was gratuitously put at the disposal of the writer by the commuune of Rodenbach.

The total weight of the 39 pigs before grazing was 2 056 lbs. or 52.6 lbs per head. The total purchase price was 2 541 marks, from which the price per pound of live weight is calculated to be 1.23 marks. The pigs are described as being of excellent quality.

The animals were put on pasture in three separate lots : 17 on September 4, 2 on September 9, and 20 on September 19. The forest is composed chiefly of oaks and beech-trees and has an area of 111 acres. During the night the pigs were brought back into a common stable of the village. Every morning and evening each pig was given some pounds of a supplementary food composed of molasses, bran, cocoa-cake, maize and potatoes, 55.6 cwt. being administered altogether, but the principal forage was furnished by the forest. The trees and game suffered no damage from the pigs. The latter were taken off the pasture, some in October, some in November and the remainder in December. One had died 17 days after being put on pasture, and three, on account of their abnormal developement, had to be slaughtered before the end of the experitent. Altogether the animals spent 3 189 days in the forest, or 81 days per pig. In this period the total increase in weight was 1 785.5 lbs. that is scarcely 8.8 oz. per day, the four pigs eliminated being included in the calculation. On the other hand with some animals increase amounted to 8.8 to 13.2 oz.

The financial result of the experiment was as follows:

| | | |
|---|---|---|
| Cost of the 39 pigs | 2 541 | *marks* |
| Concentrated food and cost of feeding | 1 426 | |
| Rent of stable, repairs of fences | 20 | |
| Wages of swineherd | 47 | |
| Cost of transport | 21 | |
| | 4 055 | *marks* |
| *Receipts.* | | |
| Sale price of 38 pigs | 4 036 | *marks* |
| Loss | 19 | *marks* |

If all the animals had survived until the end of the experiment there would have been a profit instead of a loss. It should also be mentioned that the excessively high price of maize had a considerable effect on the result Although the latter was negative in this case, the writer believes that this method of fattening would be remunerative in Germany, since by it otherwise useless products of the forest can be transformed into valuable pork. The experiment is to be repeated in other communes.

1105 – **British Berkshire Society's Report.** — *Farmer & Stock Breeder*, Vol. XXIX, No. 1406, p. 1433. London, Sept. 4, 1916.

The British Berkshire Society (1) has issued its annual report consisting of a record of the main activities of the breed during the past year. A table of export certificates issued for the past 10 years shows that 2181 certificates have been given, 999 of which were for pigs exported to the Argentine. The United States comes next in the list with 147, Canada third with 136, Russia fourth with 129, and Brazil fifth with 127. It is remarked, as indicating the weights to which the breed will grow, that Berkshire sows at six months, in ordinary growing condition and given proper exercise, weigh from 150 to 160 lb, and boars from 160 to 170 lb. At one year sows in breeding condition weigh from 400 to 500 lb. and when full grown from 550 to 650 lb. Boars one year old in show condition have been known to weigh 600 lb. The success of the breed at Smithfield is discussed where no other breed has had such a long run of successes in the carcass classes.

1106 – **A Study of Constitutional Vigour in Poultry.** — RICE, J. E. *Cornell University Agricultural Experiment Station, Department of Poultry Husbandry, Bulletin* No. 345, pp. 439-357. Ithaca, N. Y., 1914. POULTRY

In the autumn of 1909 two experimental flocks of White Leghorn hens were formed. For the one all the largest hens were selected and it was called the strong flock, for the other, or weak flock, the smaller hens were chosen. During the next two years all the progeny were also divided up into strong and weak flocks. Both kinds of fowls were kept under identical conditions and received the usual Cornell rations for laying hens, *i. e.* a dry grain mixture made up of :

| in winter : | | | | in summer : | | | |
|---|---|---|---|---|---|---|---|
| 60 | lbs. | of | wheat | 60 | lbs. | of | wheat |
| 60 | " | " | maize | 60 | " | " | maize |
| 30 | " | " | oats | 60 | " | " | oats |
| 30 | " | " | buckwheat | | | | |

fed morning and afternoon in straw litter ; and in the afternoon only, a mash consisting of :

| | | | | |
|---|---|---|---|---|
| 60 | lbs. | of | maize | meal |
| 60 | " | " | wheat | middlings |
| 30 | " | " | wheat | bran |
| 10 | " | " | alfalfa | meal |
| 50 | " | " | beef | scrap |
| 1 | " | " | salt | |

(1) E. Humfrey, Shippon, Abingdon, Berks. Secretary.

TABLE I. — *Average food consumption per hen per annum.*

| | Strong flocks | Weak flocks |
|---|---|---|
| | lbs. | lbs. |
| Total quantity of food | 80.30 | 75.91 |
| Total quantity of food including grit and shell | 77.07 | 72.82 |
| Total quantity of food including grit, shell, and green food | 67.49 | 62.73 |
| Total whole and ground grain | 60.16 | 56.58 |
| Total whole grain | 44.46 | 44.05 |
| Ground grain | 15.70 | 12.53 |
| Meat scrap | 4.82 | 3.95 |
| Grit and shell | 3.23 | 3.09 |
| Green food | 9.58 | 10.09 |
| | per cent | per cent |
| Whole grain in total food including grit, shell, and green food | 65, 9 | 70,2 |
| Ground grain in total food including grit, shell and green food | 23.3 | 20,0 |
| Meat scrap in total food excluding grit, shell and green food | 7.1 | 6,3 |
| Grit and shell in total food including green food | 4.6 | 4,7 |

TABLE II. — *Food nutrients consumed per hen per annum.*

| | Strong flocks | Weak flocks |
|---|---|---|
| | lbs. | lbs. |
| Dry matter | 61.73 | 56.93 |
| Protein | 9.69 | 8.50 |
| Carbohydrates | 39.50 | 37.72 |
| Fat | 2.59 | 2.41 |
| Ash, including grit and shell | 1.91 | 1.73 |
| Albuminoid ratio | 1 : 4.68 | 1 : 5.08 |

The records for the two original flocks and all their progeny (amounting to 76 strong and 75 weak flocks) have been summarised for the three years 1909-1911 (Tables I to V). The strong fowls consumed more food than did the weak fowls. Both had the same amount of grain, but the strong fowls were able to consume more meal and meat scrap. Consumption of grit and shell were practically equal in the two groups. The

TABLE III. — *Consumption per unit live weight and per dozen eggs produced.*

| | Strong flocks | Weak flocks |
|---|---|---|
| Dry matter consumed per pound of live weight, in lbs. | 17.68 | 17.68 |
| Food consumed per dozen eggs laid, in lbs. | 7.68 | 8.46 |
| Cost of food per dozen eggs laid. | $0.114 | $0.123 |
| Total number of eggs produced per hen | 125.36 | 107.61 |

TABLE IV. — *Hatching and mortality records.*

| | | Strong flocks | Weak flocks |
|---|---|---|---|
| Number of eggs set. | | 1.446 | 1.305 |
| Percentage of fertile eggs | | 89.4 | 91.4 |
| Percentage of eggs hatched in fertile eggs. | | 55.4 | 56.4 |
| Percentage of eggs hatched in number set | | 49.6 | 51.5 |
| Average weight of eggs set in pounds. | | 0.2081 | 0.2198 |
| Average weight of chicks hatched in lbs | | 0.09096 | 0.0767 |
| Percentage mortality of chicks to six weeks of age | | 23.15 | 19.64 |
| Flock mortality | Total number of hens | 108 | 104 |
| | Total number of deaths | 12 | 12 |
| | Percentage mortality | 11.1 | 12.5 |

TABLE V. — *Average receipts and expenses per hen per annum.*

| | Strong flocks | Weak flocks |
|---|---|---|
| | $ | $ |
| *Receipts :* | | |
| Value of eggs | 3.12 | 2.67 |
| Value of gain in live weight | 0.07 | 0.06 |
| Total | 3.19 | 2.73 |
| *Expenses :* | | |
| Cost of food | 1.19 | 1.10 |
| Cost of loss of stock | 0.08 | 0.11 |
| Total | 1.27 | 1.21 |
| Balance profit | 1.92 | 1.52 |

number of lbs. of dry matter eaten per lb. of live weight averages the same for both strong and weak birds (Table III), but whereas the strong fowls required only 7.68 lbs. of food for every dozen eggs laid, the weaker flocks required 8.46 lbs. After the first period of the experiment, egg production was consistently heavier in the strong flocks, the difference amounting to 17.75 eggs per hen per annum and being sufficient to justify the selection of stronger pullets for egg production.

1107 – **Rations for Growing and Fattening Roasters and Capons.** — Buss, W. J., *Ohio Agricultural Experiment Station. Bulletin* No. 284, pp. 155-172. Wooster, Ohio, 1916.

*Experiment* 1. — The object of this experiment was to compare the relative efficiency and economy of the different rations for the production of roasters and capons, and to determine the amount of feed required to produce one pound of live weight increase. The chickens used were 139 pure and 56 cross-bred Barred Plymouth Rocks, the crossbreds being the offspring of Light Brahma and Leghorn crosses. Of these 195 birds 94 were cockerels, all except 8 of which were caponised when 4 months old. At the start the chicks were only two months old and they were kept under experiment for 32 weeks.

The five rations in question are given below.

| Ration | Grain | Mash |
|---|---|---|
| I | maize | 2 parts ground maize.<br>1 " beef scrap. |
| II | maize | 1 " ground maize<br>2 " beef scrap.<br>The amount of maize was increased one part each week so that by the 32nd week, the mash consisted of:<br>32 parts ground maize.<br>2 " beef scrap. |
| III | 11 parts maize<br>15 " wheat<br>4 " oats | 2 " ground maize.<br>2 " bran.<br>1 " beef scrap. |
| IV | maize | 7 " ground maize.<br>3 " tankage. |
| V | maize | 3 " ground maize.<br>4 " oilmeal.<br>Ration fed for 12 weeks by which time the chicks were doing so badly that they had to be put on Ration I. |

In addition all birds had access to grit, charcoal and an abundant supply of water. The mash was kept in hoppers to which the fowls had access at all times.

*Experiment* 2. — The feeding trials were repeated with 125 purebred Plymouth Rock capons, using exactly the same rations as before, except in the case of the fifth group where the birds were fed on ration I, but were confined to small pens instead of being allowed to range. Four to four and a half months old birds were chosen and the experiment lasted 19 weeks.

The adjoining Table summarises the results of the two experiments. Taking the average of both trials, ration I produced a slightly higher rate of gain than did the others. Ration II which contained a constantly decreasing amount of protein lowered the rate of gain and raised the food consumption. The bird, fed on ration III consumed the most food per bird and per pound of live weight increase ; the cost of the food for this group was about 30 per cent higher than that for the others. Capons confined to small pens, while consuming only 2 per cent less feed per bird, gained about 17 per cent less than capons allowed to range, and the cost of their food was consequently 17 per cent higher. Prices of foods used in the calculations were as follows :

| | Price per cwt. | | Price per cwt. |
|---|---|---|---|
| | $ | | $ |
| Shelled maize | 1.00 | Beef scrap | 2.75 |
| Ground " | 1.09 | Tankage | 2.40 |
| Wheat | 1.50 | Oil meal | 1.80 |
| Bran | 1.40 | Grit | 0.75 |
| Oats | 1.25 | Charcoal | 2.25 |

In the first experiment where pullets, cockerels and capons were fed together, capons invariably made the most rapid gains, the average total live weight increase being for capons 6.8 lbs., for cockerels 6.1 lbs. and for pullets 4.6 lbs.

*Comparative efficiency of rations for fattening roasters and capons.*

| Ration | Average total gain per bird | | | Average total consumption per bird | | | Food consumed per lb. of live weight increase | | | Cost of food per lb. of live weight increase | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Experiment | | Mean | Experiment | | Mean | Experiment | | Mean | Experiment | | Mean |
| | 1 | 2 | | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | lbs. | cents. | cents. | cents. |
| I | 6,5 | 4,6 | 5,55 | 47,2 | 37,7 | 42.4 | 7,3 | 8,1 | 7,7 | 9,1 | 10,1 | 9,6 |
| II | 6,4 | 4,5 | 5,45 | 49,2 | 38,8 | 43,5 | 7,7 | 8,6 | 8,1 | 8.7 | 10,3 | 9,5 |
| III | 6,6 | 4,4 | 5,50 | 55,8 | 41,3 | 48,5 | 8,5 | 9,2 | 8,8 | 11,7 | 13,2 | 12,4 |
| IV | 5,9 | 4,6 | 5,25 | 45,5 | 37,6 | 41,5 | 7,7 | 8,2 | 7,9 | 9,1 | 9,8 | 9,4 |
| V | 5,8 | 3,8 | 4,80 | 43,5 | 36.2 | 39,8 | 7,5 | 9,5 | 8,5 | 9,3 | 11,9 | 10,6 |

*Results expressed as a percentage of those fed on ration I.*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| II | 99 | 97,1 | 98,2 | 104,3 | 103 | 104,8 | 105,3 | 106,1 | 105,1 | 95,4 | 101,6 | 97 |
| III | 102 | 96,7 | 99,5 | 118 | 109,6 | 115,4 | 115,4 | 113,8 | 114,5 | 128,3 | 130,5 | 128,7 |
| IV | 91,6 | 99,2 | 94,5 | 96,4 | 99,8 | 98,1 | 104,8 | 100,6 | 103,2 | 100,1 | 96,8 | 98,8 |
| V | — | 82,4 | — | — | 96,1 | — | — | 117,1 | — | — | 117,5 | — |

FISH CULTURE.

1108 **Investigations on the Number of Eggs Produced by Certain Fish.** — MART. H., in *Allgemeine Fischerei-Zeitung*, Year XLI. No. 16, pp. 255-260. Munich, August, 15, 1916.

Very little is known with regard to the exact number of eggs produced by various species of fish ; hitherto only rough estimates have been made or where experiments have been carried out, the females have not been of the same age. At the Bavarian trout hatchery (Starnberg), 58 common trout (*Trutta fario*) and 54 rainbow trout (*Trutta iridea*) were stripped and the ova were carefully counted with results given in Tables I and II.

It would appear that the heavier, *i. e.* the older, the fish the greater the number of eggs produced ; but if the results are considered from the point of view of production per unit weight, the young fish yield a relatively larger number of eggs, though the eggs are not so heavy. In other words with a given quantity of matter young fish form a larger number of eggs than do older fish.

As these results could be questioned on the grounds that some of the fish might have been incompletely stripped or that the fish might have

TABLE I. — *Number of eggs produced by common trout.*

| Weight of fish | | | | | No. of eggs per fish | Weight of eggs per 100 parts live weight | Weight 1000 eggs | No. of eggs per unit weight of live weight (1 kilog.) |
|---|---|---|---|---|---|---|---|---|
| lbs. | oz. | | lbs. | oz. | | | oz. | |
| | 7 | — | | 8.5 | 707 | 23,6 | 2.7 | 2 993 |
| | 8.5 | — | | 10.5 | 751 | 22,0 | 2.9 | 2 646 |
| | 10.5 | — | | 14 | 879 | 20,4 | 3.1 | 2 594 |
| | 14 | — | 1 | 5 | 1 090 | 21,0 | 3.4 | 2 178 |
| 1 | 5 | — | 2 | 11 | 1 293 | 19,3 | 3,7 | 1 829 |
| over | | | 2 | 11 | 3 017 | 19,1 | 3.6 | 1 839 |

TABLE II. — *Number of eggs produced by rainbow trout.*

| Weight of fish | | | | | No. of eggs per fish | Weight of eggs per 100 parts live weight | Weight of 1000 eggs | No. of eggs per unit weight of live weight (1 kilog.) |
|---|---|---|---|---|---|---|---|---|
| lbs. | oz. | | lbs. | oz. | | | oz. | |
| | 8.5 | — | | 10.5 | 945 | 18.0 | 1.7 | 3 577 |
| | 10.5 | — | | 14 | 1 154 | 16.6 | 1.6 | 3 323 |
| | 14 | — | 1 | 5 | 1 547 | 17.4 | 2.0 | 3 065 |
| 1 | 5 | — | 2 | 11 | 1 975 | 16.1 | 2.4 | 2 332 |
| over | | | 2 | 11 | 2 798 | 15.8 | 3.0 | 1 823 |

TABLE III. — *Number of eggs produced by perch.*

| Length of body | Weight of body | Weight of eggs | No. of eggs per fish | Weight of eggs per 100 parts live weight | No. of eggs per unit weight live weight (1 kilog.) |
|---|---|---|---|---|---|
| in. | oz. | gms. (1) | | | |
| 10.2 | 8.7 | 31.00 | 30 480 | 12.4 | 121 000 |
| 9.3 | 6.9 | 23.20 | 26 390 | 12.0 | 129 000 |
| 8.5 | 6.5 | 34.50 | 24 980 | 18.0 | 133 000 |
| 9.3 | 6.0 | 27.60 | 23 740 | 16.2 | 139 000 |
| 7.3 | 3.7 | 14.00 | 14 700 | 13.1 | 137 000 |
| 7.1 | 2.4 | 10.40 | 11 160 | 15.0 | 159 000 |
| 7.1 | 2.3 | 9.94 | 9 480 | 15.4 | 146 000 |
| 5.9 | 1.4 | 6.65 | 6 120 | 17.0 | 157 000 |
| 5.4 | 0.9 | 3.97 | 4 190 | 15.3 | 160 000 |
| 5.2 | 0.9 | 5.10 | 4 810 | 20.0 | 188 000 |
| 5.1 | 0.8 | 5.05 | 4 060 | 22.5 | 184 000 |
| 5.0 | 0.7 | 4.46 | 4 320 | 22.0 | 203 000 |
| 4.0 | 0.4 | 3.14 | 3 710 | 18.5 | 218 000 |
| Mean 6.9 | 3.8 | 13.77 | 12 934 | 16.7 | 159 538 |

(1) 1 gm. = 0.035 oz. = 0.56 drachms.

TABLE IV. — *Number of eggs produced by roach, ruffe, and Chondrostoma nasus.*

| | Length of body | Weight of body | Weight of eggs | No. of eggs per fish | Weight of eggs per 100 parts live weight | No. of eggs per unit weight of live weight (1 kilog.) |
|---|---|---|---|---|---|---|
| | in. | oz. | gms. | | | |
| Roach . . . . . | 9.8 | 8.3 | 37 | 66 250 | 15.5 | 275 000 |
| *Chondrostoma nasus* . | 14.4 | 23.6 | 97.75 | 32 250 | 13.4 | 44 500 |
| Ruffe. . . . . | 5.9 | 13 | 4.71 | 4 705 | 12.7 | 370 000 |

begun to spawn before they were captured, the experiments were repeated using perch (*Perca fluviatilis*). Females just about to spawn were killed and weighed. Their ovaries were removed, part of each was dissected, the ova were counted and accurately weighed. The weight of the whole ovary was likewise determined and from this, the number of eggs in each fish was calculated. The results are given in Table III and confirm those obtained in the previous experiments.

A few relevant figures for roach (*Leuciscus rutilus*) for *Chondrostoma nasus*, and for the ruffe (*Acerina cermua*) are appended in Table IV.

1109 - **The Improvement of Carp and Pikeperch Fisheries in Lake Balaton, Hungary**(1). — REPASSY, M. in *Halaszat* (Fishing), Year XVII, No. 10, pp. 93-99. Budapest, May 15, 1916.

In 1915, the company which holds the fishing rights of Lake Balaton adopted a new scheme for restocking the lake. It was decided to propagate the more valuable kinds of fish and more especially carp and pikeperch, the latter being the species of the greatest economic importance. The close season was fixed for the whole of the month of April. During that period artificial spawning beds are to be laid down in places frequented by pikeperch, and when spawning is finished the ova are to be collected and placed in baskets close in to the shore and where the water is fairly still. Five hundred spawning beds are to be used and it is expected that the eggs collected will amount to at least 50 millions. Every autumn 10 tons of selected fry will be set free in the lake. This will consist either of one year old pikeperch averaging 2 3/4 to 3 1/2 ozs. or two year old carp weighing from 3/4 to 1 1/2 oz.

Ever since the fishing was brought under revised management in 1900, careful records have been kept of the amounts of the different species taken from the lake. The figures from 1900-1915 are given in Table I. The total amount of fish landed varies considerably from year to year. Daily catches even are extremely irregular, in one instance there is a record of as much as 30 tons being taken in one day in the Siolfolk fishing ground alone. To eliminate these variations as much as possible the figures have been collected into two 6 year periods in Table II.

Treated in this way the records show that there has been a perceptible change in the proportion which valuable species bear to inferior ones, resulting in a small increase of the former. With regard to the total production, there has been little variation between the two periods, the annual produce being 15.7 lbs. in the first period and 15.5 lbs. during the second period per cadastral arpent. These figures are low compared to yields obtained in artificial lakes, and bearing in mind the limits of the food supply in natural waters it would appear that they are not susceptible to much increase. The improvement of the fishery will rather be in the direction of developing the valuable species at the expense of the inferior ones which are still six times more numerous than carp and pikeperch. During the second six years' period the slight change in ratio between the valuable and inferior kinds (about 10 per cent) made a difference in the returns of over £ 750 per annum ; and if it were possible to replace another 100 tons of bream or shad by 100 tons of carp the annual value of the fish landed might be increased by about £ 3000.

In the years 1901, 1906 and 1909 carp fry were set free in Lake Balaton and it may be seen from Table I. that these attempts at stocking the lake had a distinct effect on the catches of the following seasons.

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(1) See *B.* Feb. 1916, pp. 180-187 : *Fishing and Fish Cultu e in Hungary.* Original article by J. DE LANDGRAF.

TABLE I.

*Amounts of the different kinds of fish taken in Lake Balaton, 1900-1915 (long tons).*

| Year | Inferior kinds | | | Valuable kinds | | | | Total production | Ratio: inferior kinds to valuable kinds | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| | Bream | Thwaite Shad (*Alosa Finta*) | *Aspius rapax* | Pikeperch | Carp | Sheat fish *Silurus glanis* | Pike and tench | | | |
| 1900–1901 | 450 | 327 | 15 | 80 | 4 | 7 | 29 | 912 | 6,7 : 1 | |
| 1901–1902 | 283 | 131 | 6 | 92 | 4 | 2 | 21 | 540 | 3,5 : 1 | Fishing under ice. |
| 1902–1903 | 494 | 90 | 11 | 91 | 10 | 6 | 31 | 734 | 4,3 : 1 | |
| 1903–1904 | 498 | 314 | 11 | 58 | 9 | 5 | 16 | 911 | 9,4 : 1 | |
| 1904–1905 | 622 | 178 | 8 | 84 | 7 | 4 | 14 | 917 | 9,9 : 1 | |
| 1905–1906 | 353 | 151 | 8 | 74 | 7 | 5 | 12 | 610 | 5,2 : 1 | » » » |
| 1906–1907 | 562 | 68 | 8 | 100 | 7 | 5 | 21 | 772 | 4,8 : 1 | |
| 1907–1908 | 472 | 176 | 9 | 78 | 7 | 5 | 29 | 776 | 5,5 : 1 | |
| 1908–1909 | 534 | 131 | 15 | 92 | 14 | 6 | 15 | 806 | 5,4 : 1 | |
| 1909–1910 | 514 | 112 | 13 | 93 | 18 | 5 | 7 | 763 | 4,2 : 1 | |
| 1910–1911 | 558 | 97 | 8 | 72 | 8 | 5 | 14 | 762 | 6,7 : 1 | |
| 1911–1912 | 414 | 160 | 9 | 82 | 8 | 6 | 23 | 702 | 4,9 : 1 | |
| 1912–1913 | 398 | 212 | 11 | 71 | 11 | 7 | 13 | 725 | 6,0 : 1 | |
| 1913–1914 | 292 | 59 | 13 | 63 | 7 | 6 | 9 | 448 | 4,3 : 1 | Scarcity of labour. |
| 1914–1915 | 322 | 73 | 3 | 38 | 3 | 2 | 8 | 451 | 7,5 : 1 | |

TABLE II.

*Comparative yields of fish from Lake Balaton in two 6 year periods,* 1900-1906 *and* 1900-1912 (*long tons*),

| Year | Inferior kinds | | | Valuable kinds | | | | Total production | Ratio: inferior kinds to valuable kinds |
|---|---|---|---|---|---|---|---|---|---|
| | Bream | Bleak (*Alosa Finta*) | *Aspius rapax* | Pikeperch | Carp | *Silurus glanis* | Pike and tench | | |
| | | | | | | | | | |
| *Total amounts.* | | | | | | | | | |
| 1900–1906 . . . . . | 27 01 | 11 91 | 59 | 4 79 | 41 | 30 | 1 23 | 46 23 | 5,7 : 1 |
| 1906–1912 . . . . . | 30 54 | 7 43 | 62 | 5 18 | 61 | 33 | 1 08 | 45 80 | 5,2 : 1 |
| Difference. . . . . | + 3 53 | — 4 48 | + 3 | + 39 | + 20 | + 3 | — 15 | — 43 | |
| *Mean annual yield.* | | | | | | | | | |
| 1900–1906 . . . . . | 4 50 | 1 98 | 9,8 | 80 | 7 | 5,0 | 20 | 7 70 | |
| 1906–1912 . . . . . | 5 09 | 1 24 | 10,4 | 86 | 10 | 5,5 | 18 | 7 63 | |
| Difference. . . . . | + 59 | — 74 | + 0,6 | + 6 | + 3 | + 0,5 | — 2 | — 7 | |
| Difference per cent . . . | + 13% | — 38% | + 6% | + 8% | + 49% | + 10% | + 12% | — 1% | |

## FARM ENGINEERING.



1110 – **Machinery Cost of Farm Operations in Western New York.** — MOWRY, H. H. in *Bulletin* No. 338. *United States Department of Agriculture.* Washington, D. C., January 18, 1916.

The aim of the writer (Assistant Agriculturist, Office of Farm Management) is to determine what is, under normal conditions, the average service given by agricultural implements generally in use in seven different counties in New York State: Niagara, Orleans, Monroe, Wayne, Genesee Livingston and Ontario. In response to an enquiry addressed to several thousands of farmers, reports were received on some thousands of machines of 19 different kinds: 1 165 walking ploughs, 294 sulley ploughs, 1 169 spring-tooth harrows, 824 spike-tooth harrows, 738 disc harrows, 1 173 land rollers, 1 061 grain drills, 72 one-row corn planters, 97 two-row corn planters, 1 114 one horse cultivators, 881 riding cultivators, 217 cabbage transplanters, 359 engine sprayers, 1 232 mowers, 1 217 hay rakes, 416 hay tedders, 563 bean harvesters, 1 028 grain binders, and 458 corn binders.

*Method of Computing Replacement Costs.* — The replacement charge per year, per acre, or per day is based on the proportional use and not on the sale price of the machine at any time during its life. For the farmer who expects to remain in business for a period exceeding the life of the machine, this is the logical method to use.

The tables of which we give an extract, will be found useful in estimating the machinery cost of work and the fair charge against work already done. They will also assist the man expecting to give up farming and sell his machinery, or wishing to buy secondhand implements. Both buyer and seller will then have a fair means of arriving at a fair value in their transactions.

*Method of Computing the Interest Charge* (1). — Where a part of the first cost of equipment is charged off annually to provide for its replacement, the average investment upon which interest must be allowed is shown in the table below:

*Method of Determining the Service of Farm Machinery.* — The writer describes the method used to obtain his results: it is based on the average figures for each type of implement in New York State.

The service expressed in acres was obtained by multiplying the service in years by the average work done annually. The work in days was found

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(1) The average investment in equipment, where a fraction of its first cost is charged off each year for replacement, may be found by the rule:

$$\text{Average investment} = \text{first cost} \times \frac{\text{years of service} + 1}{\text{years of service} \times 2}$$

By multiplying the average investment by the prevailing rate of interest in the locality where the equipment is located the annual interest charge against the equipment is found.

*Technical Data Relating to the Different Machines.*

| Kind of machine | Average area covered annually — Acres | Average length of service rendered — Years | Average area covered during life — Acres | Average cost when new — $ | Average cost of repairs during life — $ | Total interest during life at 6 % — $ | Total cost of machine during life — $ | Remarks |
|---|---|---|---|---|---|---|---|---|
| *Cultivating machines:* | | | | | | | | |
| One-horse cultivator | 16.9 | 14 | 236.6 | 6.50 | 4.90 | 2.94 | 14.34 | Most economical on larger areas. |
| Riding cultivator | 39.3 | 12.5 | 491.3 | 32.00 | 12.38 | 13.00 | 57.38 | The overhead charges are more than twice those for the one-horse machine. |
| Walking plough | 32.9 | 11.7 | 384.9 | 10.00 | 23.99 | 3.86 | 37.85 | Very strong; repairs expensive; price low. |
| Sulky plough | 30.9 | 8.1 | 250.3 | 42.50 | 17.17 | 11.58 | 71.25 | Heavy wear on working parts. |
| Spike-tooth harrow | 48.3 | 14 | 676.2 | 10.50 | 4.76 | 4.76 | 20.02 | Use not general; life $^1/_4$ longer than the following machine. |
| Spring-tooth harrow | 71.1 | 11 | 782.1 | 17.50 | 8.25 | 5.83 | 31.58 | Gives long service. |
| Disc harrow | 35.2 | 13 | 457.6 | 27.00 | 6.50 | 11.31 | 44.81 | The larger model costs $^1/_4$ more than the small. |
| Land roller | 65.9 | 16 | 1 054.4 | 24.00 | 7.52 | 11.20 | 42.72 | Low interest charge. |
| Grain drill | 46.3 | 16.4 | 759.3 | 72.00 | 20.66 | 37.56 | 130.22 | Substantially built. |
| Corn planter (2-row) | 8.3 | 11 | 91.3 | 40.00 | 18.48 | 12.41 | 70.89 | Repairs comparatively expensive. |
| Cabbage transplanter | 12.5 | 12.8 | 160.0 | 45.00 | 14.46 | 18.56 | 78.02 | Most economical on large areas. |
| *Harvesting machines:* | | | | | | | | |
| Hay tedder | 21.6 | 14 | 302.4 | 34.00 | 5.74 | 15.26 | 55.00 | Suitable for large areas. |
| Hay rake | 43 | 14.5 | 623.5 | 24.00 | 5.22 | 11.17 | 40.39 | Repairs low. |
| Mower | 28 | 14.8 | 414.4 | 41.00 | 26.94 | 19.39 | 87.33 | Average farmer does not obtain maximum work from machine. |
| Grain binder | 35.2 | 15.4 | 542.1 | 125.00 | 31.20 | 61.60 | 218.02 | Small models last longer but do less work. |
| Corn binder | 21.2 | 10.8 | 227.9 | 125.00 | 21.92 | 43.28 | 190.20 | Repairs expensive. |
| Bean harvester | 16.9 | 12.9 | 218.0 | 25.00 | 13.03 | 10.32 | 48.35 | Long life. |

| Fraction of cost new charged off annually | Average investment (per cent of first cost) | Fraction of cost new charged off annually | Average investment (per cent of first cost) | Fraction of cost new charged off annually | Average investment (per cent of first cost) |
|---|---|---|---|---|---|
| | % | | % | | % |
| All . . . . . | 100.00 | One-eighth . . . | 56.25 | One-fifteenth . . | 53.33 |
| One-half . . . . | 75.00 | One-ninth . . . . | 55.55 | One-sixteenth. . | 53.12 |
| One-third . . . . | 66.66 | One-tenth . . . | 55.00 | One-seventeenth. | 52.93 |
| One-fourth . . . | 62.50 | One-eleventh . . | 54.54 | One-eighteenth . | 52.77 |
| One-fifth . . . . | 60.00 | One-twelfth . . | 54.17 | One-nineteenth . | 52.63 |
| One-sixth . . . . | 58.33 | One-thirteenth . | 53.84 | One-twentieth. . | 52.50 |
| One-seventh. . . | 57.14 | One fourteenth . | 53.57 | | |

by dividing the service in acres by the normal acreage or day's work done by the machines.

*Cost of Repairs.* — Where ordinary care is used by the operator, the repair charges should make up but a small proportion of the total cost.

*Relation of Annual Repairs to First Cost.* — The writer gives the type of implement, the annual cost for repairs calculated as per centage of the first cost, and the average present value of the equipment. The percentage varied from 1.2 to 5.8 except for the walking plough for which the per-centage was over 20.5.

*Shelter.* — There are no data available on the relative life of machinery when housed and when not housed. Farmers allow 20 per cent of the first cost of the machine in cases where special shelter is necessary.

*Relation of Machinery Cost to Total Cost of Farm Operations.* — The writer takes account of man-time and horse-time. One man is able to manage all the implements except the cabbage transplanter which requires three men. The machine cost of the different operations does not exceed 50 per cent of the whole: ranging from 4.7 per cent for the walking plough to 42.8 per cent for the grain binder.

*Conclusion.* — The data collected by the writer should help agriculturists to determine the probable length of service for the various implements, the normal cost of repairs, and, allowing for the size of their holdings, to decide whether to buy or hire farm machinery.

1111 – **Maillet Motor Cultivator with Controlled Rotary Blades.** — FREMIEL, VICTOR, in *Le Génie rural*, 8th year, No. 62, New Series, No. 2 of 1916, pp. 9-14, Paris, July, 1916.

This invention is a distinct advance on the 2 or 3 speed motors of the usual American pattern. In practice the 2 or 3 speeds are unsatisfactory and often difficult to operate, whether by shifting the blades on their axle or by changing the speed of rotation ; this latter method leads to objectionable complication in the gear-box. In order to avoid these difficulties the inventor has combined the speed of rotation with the travelling speed. He has designed a ploughing mechanism, illustrated in Fig. 2, which consists

essentially of an axle carrying a spiral blade. This does the work of a series of little ploughs with the working parts : coulter, share and mould-board. This mechanism is caused to rotate by the same motor which moves the whole machine forward along the line of work.

As the machine moves forward, the soil along the whole length of the spiral blade is successively lifted and turned by the appropriate combined action of the rotating and travelling gears. To provide the range of speeds desired, the designer has fitted two sets of gearing operated by levers or pedals. The speed of rotation is so controlled relative to the travelling speed

MAILLET *Cultivator.*

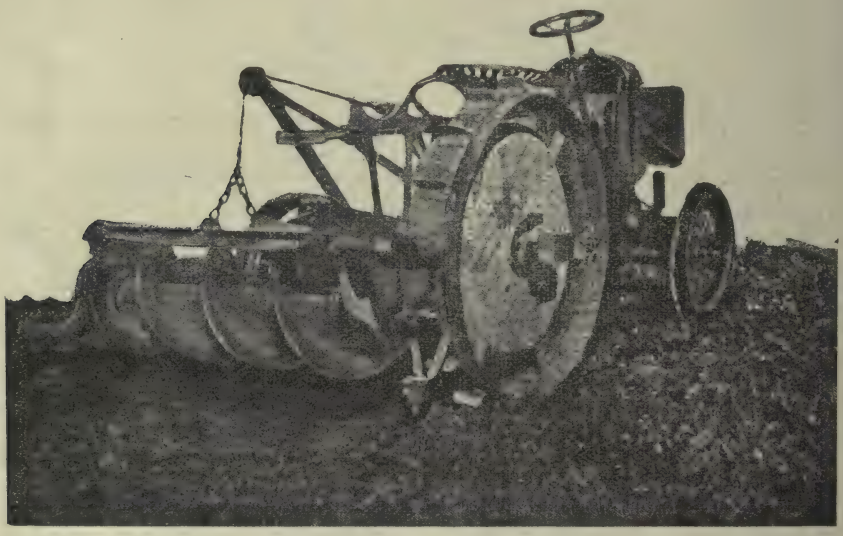


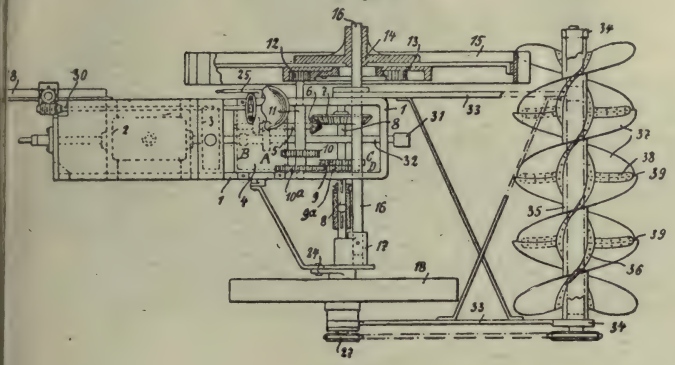
Fig. 1. — General view.

that any cut may be taken from a mere shaving to a large swathe, *i. e.* the soil is finely or coarsely cultivated.

The motor and clutch are enclosed in a case 4 (fig. 2) which contains the gears A and B giving the two speeds to the shaft 5, thence to the bevel-pinion 6 and bevel-wheel 7 keyed on the transverse shaft 8. On this shaft two pinions C and D engage with the wheels 10 and 10 a ; this allows the speed of shaft 11 to be varied according to which pair of wheels are in gear.

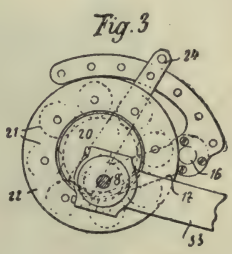
| In gear | Forward movement | Blades |
|---|---|---|
| *A* and *C* | 32.8 yards | 90 turns |
| *A* " *D* | 43.7 " | 90 " |
| *B* " *C* | 44.8 " | 130 " |
| *B* " *D* | 60.1 " | 130 " |

Fig. 2.



Plan.

Fig. 3



Clutch.

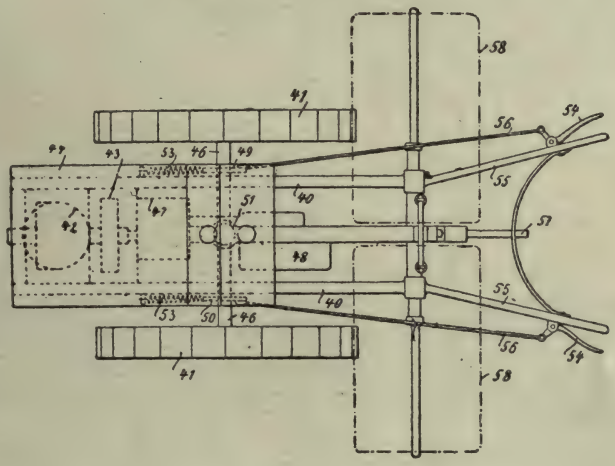


Fig. 4. — Second Model of the MAILLET cultivator.
Plan.

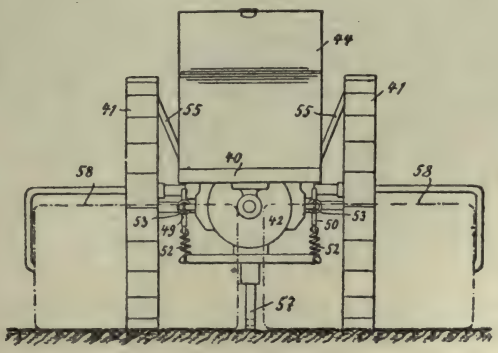


Fig. 5. — Front view.

The end of shaft 8 carries the sprocket 27 which drives the cultivator by a chain. The axle of the cultivator is cast with flanges 36 to which the spiral blades 37 are attached.

The other end of shaft 11 carries a pinion 12 which turns the driving wheel 15 through a gear 13 mounted on the hub 14.

As shown in fig. 2, the hub 14 of the driving wheel is carried far out on the axle 16 so that the load in the latter is as close as possible to the centre of gravity of the wheel. The track of the machine can be altered by moving the sleeve 17 along the axle 16 to which it can be fixed by bolts.

To keep the machine level when at work, the lever 24 (fig. 3) is used ; this is connected to a centre-piece 20 controlled by a hand lever.

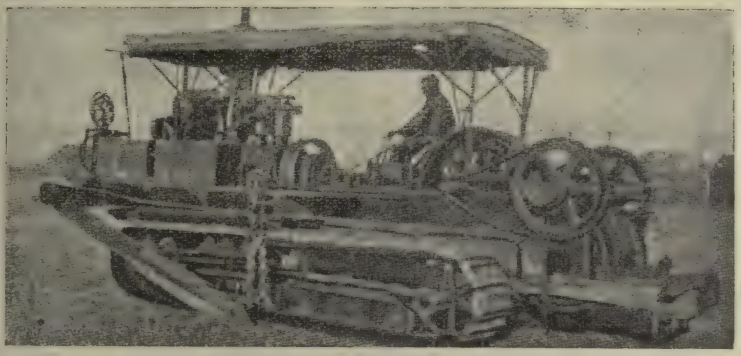
In another model, illustrated in fig. 4, the machine consists of a frame 40 carried by two wheels 41 which serve both for driving and steering; the motor 42 and clutch 43 are covered by a bonnet 44. A first gear-box 47 controls both the travelling speed and that of the implement; a second gear-box 48 acts independently on the travelling speed. This machine, like that described above, provides two changes of speed ; to keep the axle parallel with the plan of the machine on level ground, the hand controls 54 acts on the verticle springs 52 (fig. 5) ; on uneven country they allow the wheels to adapt themselves to the irregularities of the ground without altering the position of the machine laterally. Two other springs 53 act horizontally and keep the track parallel to the frame. The machine is steered by controlling these springs. A shoe 57 regulates the working depth and keeps the direction. In working ridges this shoe is furnished with a cutter.

The cultivator 58, situated in the rear, is made in two portions, one with a right and the other with a left-handed spiral, allowing for earthing up or splitting the ridges. The machine can be used for all kinds of farm work ; it will draw a plough or drive thrashing or other machines.

There is a special model for vineyard work ; the constructional details are similar to those reproduced in figs. 4 and 5.

1112 – **Petrol Tractor for Drain Digging.** — PERKINS, FRANK, in *Engineering Record*, Vol. 47, N° 5, p. 134. New York, July 29, 1916.

Weight 15 tons ; motor 60 H. P. ; 2 caterpillars 30 in. wide allow the machine to operate on soft land where teams could not well be used. The tractor carries a drum 16 in. diameter by 24 in. long which can roll 1000 ft. of $^3/_4$ in. cable ; paying-out speed : 10 to 14 ft. per minute. Mode of operation : the plough, which can dig a drain 2 feet wide and 3.5 feet deep, is attached to the tractor by the cable, the drum being- de-clutched, the tractor moves forward to the finishing point. The drum clutch is then let in and the cable wound up taut ; the tractor is kept stationary by two anchors situated in front. The cable is wound in until the plough reaches the end of the drain. When it is desired to move forward the anchors are lifted. Travelling speed : 2 miles per hour.



Petrol tractor for drain digging.

1113 – **Simple Steam Sterilizer for Farm Dairy Utensils.** — AYERS, HENRY, and TAYLOR, G. R., in *Farmers' Bulletin* 748. Washington, D. C., July 22, 1916.

The sterilizer consists of a roasting-pan A which, with its insulated cover B, forms the bottom of the box C, and is heated by a two-burner oil stove. (fig. 1).

The cover is made of galvanised iron ; the lower part is covered with asbestos and overlaps the ends of the plan. Instead of asbestos, paper com-

*Sterilizer for dairy utensils.*

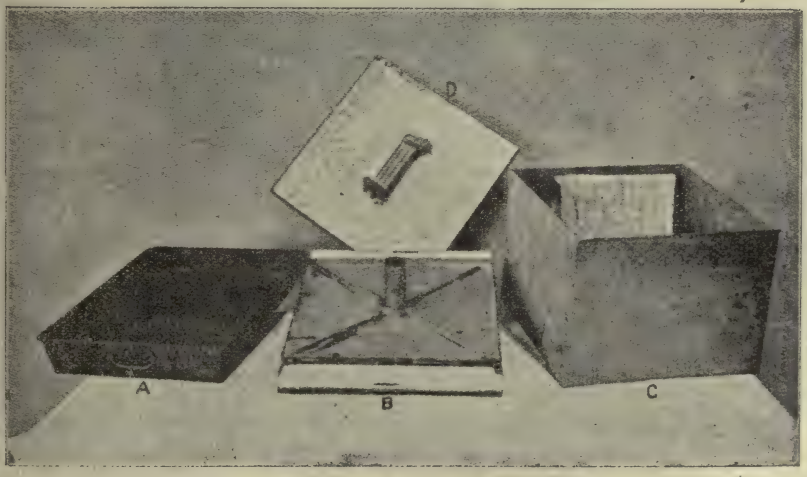



Fig. 1. — Parts for the sterilizer.

pletely enclosed in sheet iron may be used. A hole 1 ½ inches in diameter is made in the centre of the cover and a pipe soldered to it 4 ½ inches in

height. The diagonal strips on the cover B act as supports for the cans or other utensils to be sterilised.

*Method of Operation :* Fill the roasting pan with water to the depth of 1 inch. Heat until the steam coming from the end of the outlet pipe reaches a temperature of 205° F. Place the can to be sterilised, preferably enclosed in an insulating cover, upside down over the outlet and leave for

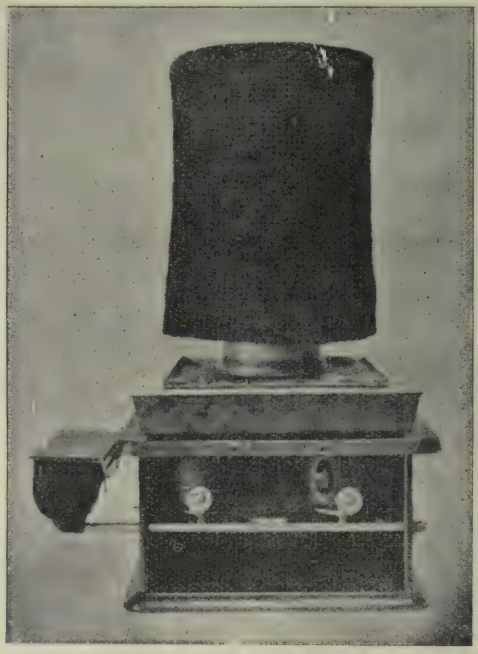


Fig. 2. — The sterilizer in action.

5 minutes, (fig. 2) then remove and place upright on the floor. The can should be absolutely dry in one or two minutes if the temperature has reached 205° F.

*Cost of Operation :* The two burners use one pint of paraffin per hour. Taking oil at 10 cents a gallon, the cost of sterilising three cans, with covers and strainers, is about 1 cent for 35 minutes operation. One inch of water in the roasting pan will furnish steam at 211° F. for about 50 minutes.

## RURAL ECONOMICS.

1114 - **Farm Management Practice of Chester County Pa., U. S. A.** — SPILLMAN, W. J., DIXON, H. M. and BILLINGS, G. A., in *United States Department of Agriculture Bulletin* N° 341, (Professional Paper), pp. 1-99. Washington, January, 17, 1916.

This report from the Office of Farm Management, United States Department of Agriculture, based on the analytical study of 643 farms in Ches-

ter County, Pa, is designed to work out a method of studying farm management in a particular district, to discover fundamental principles of farm management and to work out their application to the agriculture of the district.

The more important of the fundamental principles of farm management brought out clearly in this study, and amply confirming similar studies, are :

The type of farming followed in any given case must be adapted to local soil, climatic and labor conditions, and especially to local conditions with reference to markets and market facilities, as well as to the business conditions existing on the individual farm.

When the conditions affecting the agriculture of a region have remained stable for a considerable period local agricultural practice tends to become approximately what it should be for the best results, provided the practice which gives the best immediate returns does not unfavorably affect soil fertility. When conditions change, even slightly, if the change is permanent, local farm practice begins to change and ultimately adapts itself to the new conditions.

Success in farming, measured in terms of the family income and standard of living, is directly proportioned to the magnitude of the farm business. With the types of farming generally adapted to this locality many of the farms found in this survey are too small to permit a satisfactory standard of living.

In the matter of yield of crops per acre, the point of dimishing returns is reached on a considerable proportion of farms. Profits increase as yields increase until the yields are considerably above the average for the locality, but beyond this, increased yields are obtained at the expense of farm profits.

In quantity of product per dairy cow, the point of diminishing returns is not reached in ordinary farm practice. Hence, on dairy farms, quantity of product per cow is, on the average, a more important factor in success in farming than yield of crops per acre.

It is both easier and more profitable to increase low acre yields than high ones, and a small product per cow than a large one. In other words, profits can be increased more easily by attention to the weakest points in a system of farming. The more vital the weakness, the greater the increase in profits that can easily be made.

With a given type of farming, under given conditions, there is a certain way of dividing acreage among the several enterprises of the farm which is more profitable than any other way; that is, there is a most profitable acreage for each crop. Similarly there is a most profitable proportion of income from each source. If the acreage of any crop or the proportion of income from any enterprise be greater or less than this optimum, the profits of the farm as a whole are lowered thereby.

Certain enterprises may be distinctly profitable when occupying a minor position in the farm business and distinctly unprofitable if made major enterprises. This appears to be true of fruit growing in Chester County, and, to a less extent, of poultry keeping.

On small farms the expense of operation is much greater per unit of product than on large farms of similar type.

Diversity of the farm business is, a a rule, an important factor of success in farming. A medium degree of diversity, sufficient to give food, seasonal distribution of labor, complete utilization of land, and a considerable variety of sale products, is better than either extreme diversity or a low degree of diversity.

These general principles, applying to a wide region in the Middle Atlantic States, have led to important conclusions bearing on possible improvements in Chester County farming. The more important applications of the above principles to the agriculture of the district studied are given below.

The standard rotation of the section, viz. 1st year: corn— 2nd year: corn, potatoes and oats— 3rd year: wheat— 4th and 5th years: timothy and clover—should be changed to the following: 1st and 2nd years: corn — 3rd year: annual hay crop and potatoes — 4th year: wheat— 5th and 6th years: timothy and clover. Oats are unprofitable in this district.

The Chester County farmer should grow a little more corn than he needs for home use. The total hay area (including annual hay crop) should occupy between 40 and 50 per cent of the land under crops. It does not pay to buy hay in this districts, unless the cows are of the highest dairy type. Dairying should normally be the leading enterprise with about one cow to each 4 or 5 acres of cultivated land. The average return per cow for dairy produce is $80 and where the receipts per cow are less than $50 per annum, the larger the herd, the smaller the labour income. More heifer calves should be raised to replace old cows. Bullock fattening is not worth while, as a main line of business, except on large farms where labour is scarce. A few hogs should be fed for market but the district is unsuitable for sheep farming. As regards poultry, 100 to 150 hens are more profitable than larger or smaller flocks. Fruit and garden produce should be grown chiefly for home use. Potatoes probably occupy about their proper place in Chester County farming.

Yields per acre can profitably be increased up to about 40 per cent above the average: beyond this the labour income falls off. The latter increases with the size of the farm, but with small farms of under 40 acres, the income is too low to maintain a good standard of living.

Farms where "diversity" is about the average for the section are usually more profitable than those where farming is either more or less diverse than the average.

The following brief description will serve to show the methods used to collect and classify the data forming the basis of the present study. Chester County was chosen for these reasons: The soils of the area are extremely uniform in character, thus giving uniformity to the farm practice of the district and permitting comparison to be made without the disturbing element of variations in type of soil; the district has long since passed the stage of pioneer farming, so that the forces which control the type of farming have had sufficient time to assert themselves and produce a highly stable agri-

culture, which now changes only when economic or other conditions change. The local agriculture therefore lends itself admirably to a study of the fundamental principles of farm organisation.

This report, relating to the period March 1, 1911 to March 1, 1912, includes as has been stated above, the analytical study of 643 farms. For each of these a valuation has been made of all farm property ; the proportion of capital invested in land, buildings, live stock, implements and machinery, supplies and cash for current expenses ; the source of income and the amount from each ; the value and amount of expenditures ; and numerous other items bearing on profit in farming.

Besides this general study of each farm a full account is given of the geography, topography, geology and drainage systems of the district. Further the agricultural history of the area is surveyed, principally since 1840, when the decennial census of live stock was begun as part of the Government scheme of agricultural statistics. Table I gives some idea of the profound changes that occurred in eastern agriculture during the decade 1840 - 50. About this time there was an enormous extension of agriculture in Ohio and the Mississippi Valleys. Later, about 1870, the city of Philadelphia began to exert its influence on the local farming, and, with the increasing town populations of the neighbourhood, the dairy side of the industry became dominant.

TABLE I. — *Census data showing changes in the agriculture of Chester County.*

| Live stock and crops | 1840 | 1850 | 1860 | 1870 | 1880 | 1890 | 1900 | 1910 |
|---|---|---|---|---|---|---|---|---|
| Dairy cows | 16 000 | 19 604 | 25 900 | 32 700 | 42 400 | 49 300 | 45 700 | 45 400 |
| Other cattle | 45 000 | 35 500 | 29 900 | 21 100 | 18 400 | 12 000 | 21 700 | 19 700 |
| Swine | 64 500 | 36 600 | 31 500 | 28 200 | 34 000 | 35 600 | 30 500 | 21 400 |
| Sheep | 56 700 | 13 400 | 11 700 | 13 100 | 15 100 | 11 200 | 9 900 | 5 300 |
| Milk sold (thousands of gallons) | — | — | — | 1 598 | 5 759 | 24 000 | 17 038 | 20 206 |
| Butter produced (thousands of pounds) | — | 2 092 | 2 730 | 2 848 | 4 247 | 1 628 | 1 314 | 573 |
| Wheat (thousands of bushels) | 438 | 547 | 801 | 754 | 775 | 882 | 785 | 928 |
| Barley thousands of bushels) | 45 | 2 | 5 | 1.6 | 0.9 | 0.2 | 0.2 | 01.2 |
| Oats (thousands of bushels) | 1 080 | 1 146 | 1 227 | 1 034 | 1 137 | 868 | 925 | 777 |
| Rye (thousands of bushels) | 86 | 52 | 32 | 12 | 20 | 19 | 22 | 27 |
| Corn (thousands of bushels) | 826 | 1 339 | 1 590 | 1 540 | 1 965 | 1 959 | 2 687 | 1 882 |
| Hay and forage (thousands of tons) | 78 | 96 | 94 | 115 | 126 | 162 | 131 | 142 |

In order to make the comparisons on which the bulletin is based of real value, it was necessary to limit the work to the 378 farms on which the farmer himself took a man's part in the work of the farm. This involved the rejection of : 16 farms owned and managed by women who did none of the farm work ; 24 farms run by paid managers ; 27 farms devoted wholly

TABLE II. — *Utilisation of land and value of real estate.*

| Sizes of farms in acres | Number of farms | Average size | Tillable area | Crop area | Tillable pasture | Other pasture | Wood-land | Waste land | Value of real estate per acre | Pasture[1] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Acres | % | % | % | % | % | % | $ | % |
| 13 to 40 . | 54 | 28 | 75 | 67 | 8 | 9 | 5 | 11 | 123 | 21 |
| 41 to 60 . | 61 | 52 | 72 | 62 | 10 | 10 | 8 | 10 | 94 | 24 |
| 61 to 80 . | 60 | 73 | 72 | 63 | 9 | 11 | 7 | 10 | 94 | 24 |
| 81 to 100 . | 68 | 93 | 71 | 62 | 9 | 10 | 10 | 9 | 91 | 23 |
| 101 to 120 . | 52 | 110 | 71 | 60 | 10 | 12 | 8 | 10 | 86 | 27 |
| 121 to 160 . | 61 | 136 | 66 | 58 | 7 | 13 | 11 | 11 | 84 | 26 |
| 161 to 393 . | 22 | 203 | 73 | 58 | 14 | 10 | 11 | 7 | 87 | 29 |
| All sizes . . . | 378 | 90 | 71 | 61 | 10 | 11 | 9 | 9 | 90 | 25 |

(1) Per cent pasture is of total crop and pasture area.

TABLE III. — *Distribution of crops.*

| Acre groups | 13 to 40 | 41 to 60 | 61 to 80 | 81 to 100 | 101 to 120 | 121 to 160 | Over 160 | All farms |
|---|---|---|---|---|---|---|---|---|
| Number of farms . . . . . | 54 | 61 | 60 | 68 | 52 | 61 | 22 | 378 |
| Corn . . . . . | 23.7 | 22.1 | 20.5 | 19.6 | 20.4 | 18.2 | 18.3 | 19.8 |
| Silage . . . . . | 0.6 | 0.2 | 1.3 | 2.0 | 3.0 | 2.8 | 5.7 | 2.5 |
| Total corn . . . | **24.3** | **22.3** | **21.8** | **21.6** | **23.4** | **21.0** | **24.0** | **22.3** |
| Potatoes . . . . . | 7.9 | 8.5 | 5.8 | 6.8 | 5.9 | 4.9 | 4.9 | 6.0 |
| Wheat . . . . . | 17.4 | 18.9 | 19.5 | 18.3 | 17.6 | 18.3 | 16.9 | 18.2 |
| Oats . . . . . | 4.8 | 5.3 | 6.3 | 6.7 | 6.1 | 6.4 | 7.5 | 6.4 |
| Hay . . . . . | 39.9 | 40.2 | 44.3 | 43.8 | 42.7 | 47.2 | 44.6 | 44.0 |
| Fruit . . . . . | 3.7 | 3.0 | 2.2 | 2.3 | 3.8 | 1.9 | 1.5 | 2.5 |
| Truck . . . . . | 1.5 | 1.4 | 0.1 | 0.1 | 0.2 | 0.1 | 0.3 | 0.3 |
| Special (*a*) . . . . . | — | 0.2 | — | — | — | — | — | — |
| Miscellaneous (*b*) . . . . | 0.5 | 0.2 | — | 0.4 | 0.3 | 0.2 | 0.3 | 0.3 |
| Total . . . | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** | **100.0** |

(*a*) Tobacco. — (*b*) Millet, rye, etc.

to hot-house business, mainly mushrooms ; also 57 tenants paid cash rent, 75 a half-share, and 14 who furnished only labour and received ⅓ of the farm produce. Other records were incomplete and were discarded.

The uniformity desirable in a study of this kind is maintained in the 378 farms dealt with in Tables II, III, IV, and V, where they are divided into 7 classes according to their size.

TABLE IV. — *Animal units* per* 100 *acres of crops.*

| Kind of live stock | Size of farms in acres | | | | | | | All farms |
|---|---|---|---|---|---|---|---|---|
| | 40 or less | 41 to 60 | 61 to 80 | 80 to 100 | 101 to 120 | 121 to 160 | Over 160 | |
| Dairy cows | 20.3 | 21.2 | 19.1 | 19.7 | 23.2 | 19.2 | 18.4 | 20.4 |
| Beef cows | 0.5 | 0.3 | 0.8 | 0.5 | — | — | — | 0.3 |
| Young cattle | 1.6 | 2.3 | 2.0 | 2.3 | 2.3 | 2.4 | 2.6 | 2.4 |
| Bulls (*a*) | 0.1 | 0.4 | 0.4 | 0.6 | 0.8 | 0.7 | 0.8 | 0.5 |
| Steers | 0.1 | 0.3 | 2.3 | 0.5 | — | 0.8 | 4.6 | 1.2 |
| Horses | 11.2 | 8.9 | 7.7 | 7.2 | 6.8 | 6.2 | 6.3 | 7.2 |
| Colts (*a*) | 0.1 | 0.3 | 0.5 | 0.4 | 0.1 | 0.7 | 0.6 | 0.4 |
| Sheep | — | 0.1 | 0.1 | 0.2 | 0.8 | 0.4 | 0.7 | 0.4 |
| Hogs | 1.6 | 0.9 | 0.4 | 0.9 | 0.9 | 2.0 | 1.2 | 1.1 |
| Poultry | 4.5 | 2.7 | 2.5 | 2.1 | 1.5 | 1.4 | 0.7 | 2.0 |

*a* Number of animals per farm.

* One animal unit equals one or other of the following groups of animals, which consume equivalent amounts of food : 1 adult horse — 1 dairy cow — 2 young cattle — 5 pigs — 7 sheep — 100 poultry.

The writers have especially endeavoured to find out how the system of arming and the method of valuing the produce, affects the labour income (1) of the farmer. Thus the farms have been divided into different classes, according to the percentage of their total area devoted to each type of crop, and also according to the total cash receipts derived from each crop and the different branches of animal production. For each of these classes an " adjusted labour income " has been determined. This index has been chosen rather than the actual labour income of the farmer, so as to eliminate the size of the farm as far as possible. The farms, divided according to area, have each been assigned as an index for labour income, the percen-

(1) The labour income of the farmer is what remains of the gross profit after deducting all expenses and interest on capital at 5 per cent. The labour of the farmer's family is reckoned among the expenses at the equivalent wages. Produce consumed by the farmer's family is not included. (*Ed.*).

tage relation of the income actually realised to the average or normal income of the class to which the farm belongs. Thus if the normal income is called, 100 for each class, the index varies as a function of the factors which can, in their turn, be isolated and studied according to the method described below. Table VI, for instance, gives only the detailed figures for corn (maize). Here are set out the limits, for the district studied, between which the adjusted labour income of the farmer varies, as a percentage of the total area under this crop, and as a percentage of the total cash receipts derived from the sale of corn, beyond that fed to stock on the farm.

TABLE V. — *Distribution of receipts.*

| Size of farms in acres | 13 to 40 | 41 to 60 | 61 to 80 | 81 to 100 | 101 to 120 | 121 to 160 | Over 160 | All farms |
|---|---|---|---|---|---|---|---|---|
| Number of farms | 54 | 61 | 60 | 68 | 52 | 61 | 22 | 378 |
| | % | % | % | % | % | % | % | % |
| Source of income: | | | | | | | | |
| Dairy products | 28.9 | 33.1 | 35.9 | 38.0 | 48.1 | 39.5 | 40.5 | 39.1 |
| Dairy cattle | 4.9 | 6.4 | 5.8 | 5.7 | 3.3 | 4.8 | 4.4 | 5.0 |
| Beef cattle | 0.2 | 0.1 | 2.5 | 0.8 | — | 1.8 | 4.8 | 1.5 |
| Horses | 0.1 | 0.3 | 1.4 | 0.1 | 0.2 | 0.5 | 0.3 | 0.4 |
| Hogs | 4.5 | 2.8 | 1.2 | 2.8 | 2.6 | 3.8 | 2.3 | 2.8 |
| Sheep and wool | — | 0.1 | 0.1 | 0.3 | 0.9 | 0.4 | 1.1 | 0.5 |
| Poultry and eggs | 18.7 | 11.6 | 11.7 | 8.5 | 6.0 | 6.4 | 3.3 | 8.2 |
| Corn | 1.2 | 2.5 | 2.5 | 2.1 | 2.3 | 2.2 | 3.1 | 2.3 |
| Potatoes | 9.3 | 12.4 | 8.6 | 11.0 | 8.2 | 6.9 | 7.5 | 8.9 |
| Wheat | 5.8 | 8.2 | 9.4 | 8.4 | 8.5 | 9.0 | 8.0 | 8.5 |
| Oats | 0.2 | 0.2 | 0.2 | 0.1 | 0.1 | 0.2 | 0.3 | 0.2 |
| Hay | 9.6 | 10.0 | 13.4 | 13.6 | 12.4 | 18.4 | 16.9 | 14.3 |
| Fruit | 1,4 | 1.3 | 1.0 | 1.0 | 0.6 | 0.2 | 0.2 | 0.7 |
| Truck | 3.0 | 1.8 | 0.1 | 0.1 | 0.2 | (*d*) | 0.4 | 0.5 |
| Special (*a*) | 0.7 | 0.7 | — | — | — | — | — | 0.1 |
| Miscellaneous (*b*) | 5.1 | 4.2 | 3.1 | 3.9 | 1.7 | 1.9 | 2.7 | 2.9 |
| Feed and supplies (*c*) | 6.4 | 4.3 | 3.1 | 3.6 | 4.9 | 4.0 | 4.2 | 4.1 |

*a*) Sweet peas, 1 farm; tobacco, 1 farm. — *b*) Miscellaneous crops (rye, millet, straw, etc.), labor, lumber, or wood sold, etc. — *c*) Increase in inventory. — *d*) Less than 0.05 per cent.

The practical conclusions drawn from these statistical data have been given already. It will be sufficient to note the fact that the course followed by the most able farmers is fully justified. They have increased their corn production to suit the changed economic conditions, while the majority of their fellows lag behind and continue to grow corn chiefly for consumption on the farm.

TABLE VI. — *Relation of corn to crop area and labour income.*

| Per cent of crop area in corn | 0 to 19 | 20 to 29 | 30 to 39 | 40 + |
|---|---|---|---|---|
| Number of farms | 138 | 188 | 42 | 10 |
| Adjusted labor income | 94 | 102 | 121 | 52 |

Average percentage of corn area on the 378 farms, 22.3.

| Per cent of income from sale of corn | None | 1 to 19 | 20 + |
|---|---|---|---|
| Number of farms | 251 | 121 | 6 |
| Adjusted labour income | 95 | 113 | 55 |

The average labour income for farms classified according to size is set out in Table VII. This also shows the number of farmers in each class who reached an income of $1000 or more.

TABLE VII. — *Relation of size of farm to labour income.*

| Size of farms, in acres | Number of farms | Average size | Average labour income | % of farms with labour income $1,000 or more |
|---|---|---|---|---|
| | | Acres | | |
| 13 to 40 | 54 | 28 | $240 | 6 |
| 41 to 60 | 61 | 52 | 550 | 10 |
| 61 to 80 | 60 | 73 | 730 | 25 |
| 81 to 100 | 68 | 93 | 848 | 34 |
| 101 to 120 | 52 | 110 | 957 | 46 |
| 121 to 160 | 61 | 136 | 1 094 | 46 |
| 161 to 393 | 22 | 203 | 1 575 | 68 |
| Average | 378 | 90 | 789 | 30 |

Study of the relation of size of farm to efficient use of labour and working capital has led to the collection of data given in Table VII. These are interesting both on their own account and because they explain the results shown in Table VII.

TABLE VIII. — *Relation of size of farm to efficiency.*

| Sizes of farms, in acres | Number of farms | Productive work units per farms | | Crop acres per man | Man labour per crop acre | Value of labour per month per man | Crop acres per work horse | Work horses per man | Value of machinery per crop acre | Ratio of cost of buildings to farm income | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Man | Horse | | | | | | | Dwelling | Other buildings |
| 13 to 40 . . | 54 | 184 | 82 | 13.7 | $20.74 | $23.93 | 9.0 | 1.5 | $15,11 | 3.41 | 2.78 |
| 41 to 60 . . | 61 | 299 | 140 | 20.2 | 15.78 | 26.60 | 11.9 | 1.7 | 12.57 | 2.19 | 1.91 |
| 61 to 80 . . | 60 | 372 | 177 | 23.2 | 13.98 | 27.12 | 13.9 | 1.7 | 11.92 | 1.88 | 1.89 |
| 81 to 100 . | 68 | 475 | 226 | 25.2 | 13.46 | 28.30 | 14.5 | 1.7 | 10.79 | 1.76 | 2.03 |
| 101 to 120 . | 52 | 551 | 259 | 25.6 | 13.64 | 29.22 | 15.0 | 1.6 | 11.80 | 1.83 | 1.92 |
| 121 to 160 . | 61 | 582 | 286 | 29.0 | 11.80 | 28.50 | 16.8 | 1.7 | 9.20 | 1.62 | 1.83 |
| 160 + . . . | 22 | 856 | 444 | 31.1 | 13.05 | 33.77 | 17.4 | 1.8 | 8.94 | 1.68 | 1.91 |
| All sizes . | 378 | 439 | 211 | 27.7 | 13.69 | 28.27 | 14.7 | 1.7 | 10.88 | 1.88 | 1.96 |

The relation of the labour income to the number of days' work for men and horses for farms divided into four groups based on the number of man-work units (productive days' work per farm) is recorded in Table IX.

TABLE IX. — *Relation of units of work to labour income.*

| Man work units per farm | Number of farms | Man work units per farm | Horse work units per farm | Average size of farm | Labour income | Adjusted income |
|---|---|---|---|---|---|---|
| | | | | Acres | $ | Per cent |
| 300 and less . . . . . | 117 | 211 | 111 | 49 | 836 | 78 |
| 301 to 500 . . . . . | 129 | 395 | 198 | 88 | 703 | 94 |
| 501 to 700 . . . . . | 89 | 588 | 278 | 116 | 1 083 | 112 |
| 701 and over . . . . . | 43 | 878 | 378 | 151 | 1 668 | 152 |
| Average . . . | 378 | 439 | 211 | 90 | 789 | 100 |

Table X brings out a point of special interest. The small farmer cannot afford an adequate equipment of labour-saving machinery, and the

relative expense of implements is greater because of the smaller use that can be made of them.

TABLE X. — *Relation of size of farm to use of machines.*

| Size of farms . . . . . acres | 60 and less | 61 to 100 | 101 to 160 | Over 160 | All farms |
|---|---|---|---|---|---|
| Number of farms . . . . . | 115 | 128 | 113 | 22 | 378 |
| Items of equipment (1) . . . . . | Per cent of farms reporting | Per cent of farms reporting | Per cent of farms reporting | Per cent of farms reporting | Per cent of farms reporting |
| Disk harrow . . . . . | 22 | 27 | 39 | 64 | 31 |
| Roller . . . . . | 78 | 91 | 94 | 96 | 88 |
| Corn planter . . . . . | 43 | 63 | 74 | 82 | 61 |
| Grain binder . . . . . | 31 | 70 | 84 | 86 | 63 |
| Grain drill . . . . . | 49 | 74 | 90 | 96 | 73 |
| Hay loader . . . . . | — | 5 | 23 | 27 | 10 |
| Hay tedder . . . . . | 51 | 69 | 81 | 86 | 68 |
| Manure spreader . . . . . | 36 | 65 | 82 | 100 | 63 |
| Silo . . . . . | 3 | 12 | 24 | 45 | 15 |
| Ensilage cutter and feed grinder . | 26 | 44 | 50 | 64 | 42 |
| Engines . . . . . | 23 | 38 | 50 | 64 | 38 |
| Cream separator . . . . . | 16 | 9 | 10 | 5 | 11 |

(1) Practically all farms reported wagons, buggies, plows, harrows, mowers, rakes, cultivators, and harness.

With regard to the relation of yield per acre to the size of farm, it is important to note that the yields on the small farms are no greater than on the large. There appears to be very little relation, on the farms in this district at least, between the size of farm and yield per acre for any kind of crop.

On the other hand, there is a very distinct relation between the yield per acre and the labour income. The writers make this point clear by tabulating the adjusted labour incomes of the farms in the district divided according to the " crop index " of the group to which each farm belongs. Thus, if the *average* quantities of different crops, a, b, c... are produced on a total area $x$, and if on a particular farm it is necessary to devote to the production of the same quantities an area $y$, then the " crop index " for that farm is given by $x/y$.

In Table XI the farms are divided according to the crop index of each farm. It is evident that good yields (crop index 100-140) are more profitable than very high yields and much more profitable than very small yields.

TABLE XI. — *Relation of crop index to labour income.*

| Crop index | Number of farms | Average labour income | Average adjusted income | Average size of farms |
|---|---|---|---|---|
| | | | % | Acres |
| 84 and less | 75 | 360 | 49 | 89 |
| 85 to 99 | 91 | 616 | 74 | 90 |
| 100 to 114 | 107 | 870 | 108 | 89 |
| 115 to 139 | 92 | 1 183 | 153 | 91 |
| 140 and over | 13 | 1 005 | 130 | 82 |
| Total | 378 | 789 | 100 | 90 |

TABLE XII.

| Divided according to receipts per cow | Number of farms | Receipts per cow | Adjusted income | Labour income |
|---|---|---|---|---|
| | | | % | |
| 50 and less | 48 | $42 | 55 | $418 |
| 51 to 60 | 43 | 63 | 102 | 592 |
| 61 to 70 | 27 | 57 | 92 | 783 |
| 71 to 80 | 51 | 75 | 99 | 782 |
| 81 to 90 | 24 | 86 | 111 | 831 |
| 91 to 100 | 39 | 96 | 137 | 1 185 |
| 101 to 120 | 29 | 110 | 162 | 1 422 |
| Over 120 | 28 | 138 | 175 | 1 602 |
| Total | 289 | 80 | 111 | 906 |

TABLE XIII.

| Diversity index | Number of farms | Average labour income | Average adjusted income | Average size of farms |
|---|---|---|---|---|
| | | | % | |
| Less than 1 to 2.9 | 79 | $663 | 82 | 83 |
| 3 to 3.9 | 107 | 718 | 90 | 90 |
| 4 to 4.9 | 125 | 888 | 114 | 94 |
| 5 and over | 67 | 866 | 112 | 90 |
| Total | 378 | 789 | 100 | 90 |

TABLE XIV. — *Distribution of farm expenses.*

| | Acres | | | | | | | Total owner farms | Special farms | Total for tenant farms | Land-lord's expenses | Cash-rent tenant | Share-rent tenant |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 40 and less | 41 to 60 | 61 to 80 | 81 to 100 | 101 to 120 | 121 to 160 | Over 160 | | | | | | |
| Number of farms | 54 | 61 | 60 | 68 | 52 | 61 | 22 | 378 | 27 | 124 | 124 | 53 | 71 |
| | % | % | % | % | % | % | % | % | % | % | % | % | % |
| Paid labour | 13.0 | 15.4 | 24.4 | 28.5 | 24.6 | 30.7 | 36.1 | 26.8 | 37.4 | 23.5 | 1.2 | 19.3 | 35.0 |
| Board, paid labour | 4.2 | 4.6 | 6.1 | 7.1 | 5.8 | 6.0 | 3.5 | 5.6 | 3.6 | 5.6 | 0.1 | 4.3 | 8.8 |
| Family labour | 16.4 | 16.2 | 10.1 | 7.7 | 12.9 | 6.9 | 5.0 | 9.6 | 4.1 | 9.4 | 1.5 | 6.4 | 15.1 |
| Machinery repairs | 1.5 | 2.3 | 1.4 | 1.6 | 2.0 | 1.3 | 1.6 | 1.6 | 1.3 | 1.6 | 0.7 | 1.2 | 2.0 |
| Building repairs | 2.7 | 1.9 | 1.2 | 1.2 | 1.2 | 1.2 | 0.1 | 1.8 | 0.7 | 1.8 | 3.6 | 1.8 | 0.2 |
| Fence repairs | 1.4 | 1.1 | 0.9 | 0.8 | 1.4 | 0.8 | 0.7 | 1.0 | 1.0 | 1.3 | 4.3 | 0.2 | 0.2 |
| Drain repairs | — | 0.1 | — | 0.1 | — | — | 0.2 | 0.1 | — | — | 0.1 | — | — |
| Feed, silage, etc. | 1.1 | 0.7 | 1.1 | 0.6 | 1.1 | 0.6 | 1.7 | 0.9 | 0.1 | 0.9 | 0.8 | 1.1 | 0.4 |
| Feed, grain, etc. | 24.7 | 19.0 | 18.1 | 17.5 | 19.7 | 16.0 | 21.3 | 18.7 | 7.6 | 22.0 | 26.7 | 18.4 | 16.1 |
| Feed grinding | 1.6 | 1.8 | 1.4 | 1.5 | 1.1 | 1.3 | 1.1 | 1.3 | 0.3 | 1.5 | 1.8 | 1.1 | 1.4 |
| Ice and milk haul | — | — | 0.6 | — | 1.0 | 0.3 | — | 0.3 | — | — | — | (*a*) | (*a*) |
| Horseshoeing | 2.7 | 2.9 | 2.5 | 2.3 | 2.0 | 2.0 | 1.3 | 2.1 | 1.1 | 2.4 | 0.9 | 1.8 | 3.2 |
| Breeding fees, vet | 0.9 | 0.7 | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 | 0.8 | 0.7 | 0.9 | 0.6 | 0.9 | 0.6 |
| Seeds, plants, etc. | 3.9 | 5.8 | 4.3 | 5.1 | 3.4 | 4.5 | 3.6 | 4.3 | 2.2 | 3.9 | 6.8 | 2.6 | 2.5 |
| Fertilizer | 11.3 | 13.1 | 13.5 | 12.0 | 11.4 | 13.0 | 11.3 | 12.3 | 20.8 | 11.2 | 20.1 | 7.8 | 6.1 |
| Spray material | 0.1 | 0.1 | — | 0.1 | 0.1 | — | — | — | 0.1 | — | 0.1 | (*a*) | 0.1 |
| Twine | 0.2 | 0.4 | 0.4 | 0.4 | 0.3 | 0.4 | 0.3 | 0.4 | 0.1 | 0.4 | 0.2 | 0.3 | 0.4 |
| Thrashing | 1.4 | 1.4 | 1.6 | 1.4 | 1.2 | 1.5 | 1.3 | 1.4 | 0.4 | 1.4 | 1.4 | 0.9 | 1.4 |
| Pressing | 1.0 | 1.7 | 2.0 | 1.8 | 1.8 | 2.5 | 2.1 | 2.0 | 0.8 | 1.6 | 1.8 | 1.0 | 1.6 |
| Machine hire | 0.5 | 0.6 | 0.3 | 0.3 | 0.3 | 0.2 | — | 0.2 | 0.1 | 0.3 | 0.1 | 0.3 | 0.2 |
| Fuel, oil, barrels, etc. | 0.5 | 0.6 | 0.6 | 0.7 | 0.7 | 0.7 | 0.6 | 0.7 | 6.6 | 0.6 | 0.5 | 0.5 | 0.7 |
| Insurance | 2.7 | 2.1 | 1.9 | 1.8 | 1.6 | 1.9 | 1.9 | 1.9 | 1.2 | 2.2 | 6.0 | 0.7 | 0.9 |
| Taxes | 8.0 | 7.3 | 6.8 | 6.7 | 5.8 | 7.4 | 5.6 | 6.7 | 3.3 | 7.3 | 20.2 | 2.5 | 2.9 |
| Miscellaneous | 0.2 | 0.2 | — | 0.1 | — | 0.1 | — | 0.1 | 0.1 | 0.2 | 0.5 | (*a* | 0.2 |
| Mushroom spawn | — | — | — | — | — | — | — | — | 6.4 | — | — | — | — |
| Cash rent | — | — | — | — | — | — | — | — | — | — | — | 26.9 | — |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 1.000 | 100.0 |

*a*) Less than one-tenth of 1 per cent.

The relation of the receipts per cow to the labour income is of the first importance in a district devoted to dairy farming and this is set out in Table XII. No farmer in this district went to too great an expense to obtain a high yield of milk per cow.

In a similar way the labour income has been studied in relation to the combined effect of crop index and receipts per cow, the efficiency of farm labour and the " diversity index " of the farm. The last term requires some explanation ; it might also be called the " specialisation index ". To find this index : Take the sum of the costs for each branch, divide the cost of each branch by this sum, square each quotient, and divide unity by the sum of these squares. The relation of diversity index to labour income is given in Table XIII.

Table XIV shows in detail the nature and relative amount of expenditure for various purposes on farms of different sizes, on special farms, on cash-rent farms and on farms run on a share basis.

The writers have calculated also : the feeding cost per animal unit — the area under cereals, hay and pasture per animal unit — the amount of silage made and fed per head of cattle, divided according to the amount of stock on each farm — the rate of depreciation of dairy cows and farm horses — the value of farmyard manure per animal unit. These are the chief points in the complete analytical study which includes fifty tables of numerical data.

1115 – **Study of a Small Holding at Kirberg, District of Wiesbaden, Germany.**— BENDER, EMILE, in *Illustrierte Landwirtschaftliche Zeitung*, 35th. year, Nos. 99 and 100 Berlin, December 11 and 15, 1915.

INTRODUCTION. — Taking as basis the classification of agricultural holdings adopted by the Imperial Bureau of Statistics (1), small and medium holdings occupy 81 per cent of agricultural land in the district of Wiesbaden. In all Prussia the Wiesbaden figure is only surpassed by the district of Lunebourg, with 86 per cent of its area in small and medium holdings. But if we compare the number of holdings improved by the owners, whose chief occupation is agriculture, the district of Wiesbaden takes the lead with 182 holdings per 2471 acres (1000 ha.), with the exception of the district of Coblence. Nassau, district of Wiesbaden, is clearly a typical country of small and medium proprietors as well as of small and medium holdings.

*Situation, Climate, Extent and Distribution.* -- The holding studied lies in the old market town of Kirgberg, near Limburg, 7.5 miles from the county town and 47 miles from the railway station at Niederbrechen. The climate is temperate ; altitude varies from 574 to 984 feet. The country is slightly undulating and includes about 1000 acres of public woodland and 2 220 acres of arable fields and meadows (meadows : 10 per cent), of which about 370 acres are estate (Domänen) and 216 acres are in trust (Fidei-Kommis, or land let out in plots of 6.2 to 9.3 acres). The areas of the

(1) Small holdings : less than 5 acres. Medium holdings 5 to 250 acres. Large holdings : over 250 acres.

holding in the township are fairly uniform, ranging from 6.2 to 37 acres only.

The holding taken as a type has an area of 31.66 acres divided as follows :

| | | |
|---|---|---|
| Arable . . . . . | 28.37 acres | 89.6 per cent |
| Pasture . . . . . | 3.29 " | 10.4 " " |

The arable land is divided into 45 plots, varying in size from 0.31 to 1.54 acres. These are cultivated on the three course rotation, usual in this district.

*Cultivation.* — Rye follows potatoes or fodder-beets ; in 1914, the year to which the report refers, it occupied 6.0 acres.

Wheat follows clover and beets (harvested late) on 2.74 acres. Before sowing, the grain is treated with 2 per cent solution of copper sulphate. An area of 0.90 acres, also sown with corn, had to be resown to oats, as the wheat was damaged by crows and mice.

The stubbles are turned in by surface ploughing, followed by the harrow. In autumn harrowing and deep ploughing is done, then, in spring, another harrowing preceds the drill. The amounts of seed used are as follows:

| | bushels per acre | area sown |
|---|---|---|
| | — | — |
| Oats " Beseler II " . . . . . | 2.5-3.2 | 5.06 acres |
| " " Lochow Gelbhafer " . . . . | 2.3-2.5 | 1.80 " |
| Barley mixed with clover . . . . . | — | 2.53 " |
| " without clover . . . . . | — | 0.35 " |

The barley most grown is Goldthorpe ; on poor soils the earlier sort Schwanenhals has been tried. The barley is used as fodder on the holding, a small amount only being sold to the brewery.

Clover occupied, in 1914, 3.0 acres and potatoes 3.8 acres. For the latter the preliminary cultivation of the soil is very thorough. Stubble is turned in and dung ploughed under, followed by light harrowing. In autumn deep ploughing and in spring the Cambridge-roller and the harrow are used, and lastly the furrows are made with the ridge-plough. After setting, the furrows are closed by the ridge-plough then, according to circumstances, comes the roller, the Cambridge-roller or the harrow. Later the horse-hoe and hand weeding are employed between the rows and finally the ridge-plough is used again.

Modrows Industry is the potato most favoured and, as early varieties, the following are grown in turn : Kaiser Krone, Gelbe Zwickauer, Ella and Royal Kidney.

In 1914, 2.5 acres were devoted to beets following oats. The soil is prepared in the same way as for potatoes, the seeds are either sown at 10 inches apart then planted out at the end of May or sown direct with the drill. For some years past, sorts specially selected for yield have been used, no-

tably Leutewitzer for sowings intended to be replanted and Eckendorf for sowing direct.

*Manure.* — The abundant stock supplies plenty of dung and liquid manure as much concentrated food is bought and the manure is carefully stored. The latter is only applied to the roots at the rate of 20 tons per acre. Potatoes get besides 268 lbs. of " A. S. 7×9 " (ammonium superphosphate giving 7 % ammoniacal nitrogen and 9 % water soluble phosphoric acid) with 134 lbs. of potash salt.

Beets receive the same manure, plus 8000 to 9000 galls. of liquid manure and 268 lbs. of kainit per acre ; while rye has 268 lbs. of " A. S. 7 × 9 " 535 lbs. of basic slag, and 9.000 galls. of liquid manure. Wheat is not manured after clover ; after beets, 535 lbs. of basic slag followed by 71 lbs. of nitrate of soda in spring. Oats are given 268 to 357 lbs. of " A. S. 7×9 " and, on poor land, a little liquid manure. Barley mixed with clover receives 535 lbs. of slag and 357 lbs. of kainit per acre ; pastures are manured in a similar way.

The soil has been examined by the Weileburg School of Agriculture and found to be very deficient in lime. Potash salts are not much used in the district, yet they are very effective as shown by the following experiment made in 1911 :

| Manure (plots of 0.62 acre) | Yield of beets |
|---|---|
| 12.3 tons of dung + 2,200 galls. of liquid manure + 110 lbs. of super . . . . . | 15.06 tons |
| 12.3 tons of dung + 2,200 galls. of liquid manure + 110 lbs. of super + 330 lbs. of kainit . . . . . | 18.06 " |

The beets from the plot dressed with kainit kept much better than those from the other plot.

*Yields.* — The following Table gives the yields from 1896 to 1913.

*Average yields per acre.*

| Year | Rye (Bushels) | | Wheat (Bushels) | | Oats (Bushels) | | | Barley (Bushels) | | Potatoes (Tons) | | | | | | | Hay (Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Old local rye | Petkuser | Molds red prolific since 1902 | Square head | Heines Ertrag reichster | Beseler II | von Lochows Gelbhafer | Old local barley | Goldthorpe | Magnum Bonum | Up to date | Sass | Cimbals Neue Export | Professor Wohltmann | Industrie | Précoce | Meadow hay 1st and 2nd crops (drained since 1905) |
| Average 1896-1905 | 37.2 | — | 33.3 | — | 56.3 | — | — | 30.3 | — | 6.65 | — | — | — | — | — | — | 2.41 |
| 1906 . . . . . | 43.6 | — | 34.0 | — | 43.3 | — | — | 35.0 | — | 5.97 | — | — | — | — | — | — | — |
| 1907 . . . . . | 39.6 | — | 33.7 | — | 55.2 | — | — | 39.2 | — | 3.38 | — | 7.40 | 6.45 | — | — | 4.62 | 3.53 |
| 1908 . . . . . | 34.0 | — | 31.4 | — | 59.9 | 68.8 | — | 37.0 | — | — | 7.80 | 6.29 | 8.92 | 6.37 | — | 4.94 | 3.74 |
| 1909 . . . . . | 39.0 | 48.9 | 34.6 | 36.1 | — | 70.1 | — | — | 53.2 | — | 9.32 | — | 9.87 | 5.33 | 7.01 | 5.50 | 4.13 |
| 1910 . . . . . | — | 47.2 | 39.1 | — | — | 73.5 | — | — | 34.1 | — | 5.18 | — | 7.96 | 3.23 | 8.36 | 4.86 | 4.76 |
| 1911 . . . . . | — | 54.8 | 40.5 | — | — | 84.5 | — | — | 52.2 | — | 8.16 | — | — | 4.38 | 7.80 | 5.73 | 4.06 |
| 1912 . . . . . | — | 47.2 | 41.4 | — | — | 82.4 | — | — | 49.7 | — | 9.40 | — | — | — | 9.40 | 8.20 | 5.06 |
| 1913 . . . . . | — | 46.4 | 39.7 | — | — | 85.4 | 91.8 | — | 58.0 | — | 3.43 | — | — | — | 11.15 | 7.80 | 6.13 |

The exact yields of straw and beet are not known. With regard to wheat Molds Red Prolific was chosen in 1911 as it stands cold well and the grain, owing to its good milling quality, fetches a better price than other foreign sorts grown in the district. Squarehead does not stand the winter well and yields poorly, so it has been given up. Criewener 104, a good yielder but rather late, has also been tried as well as Strubs square.

Broad casting was dropped in 1911 ; the drill was introduced very opportunely, as this year was exceptionally dry.

*Agricultural improvements.* — The old organisation was changed in the autumn of 1905 and from this date progress has been rapid. Formerly the approaches to the holdings were sown and their use forbidden by police order, from seed time to harvest. Now, plots of less than 0.3 acre have vanished, and the area includes only 4600 plots instead of 8000. Unfortunately they are still too small for harvesting machines to be used.

Other agricultural improvements are : new drainage systems and repair of existing systems ; clearing of watercourses and levelling of the soil.

*Stock.* — The holding studied carried 14 head of cattle, equivalent to one animal, weighing 1 100 lbs. to 2.9 acres, compared with one animal to 5.7 acres for the period 1896-1905. The increase is due to the growth of vegetable produce and the dearness of meat. Efforts are made to obtain a good yield of milk, as well as to find animals well shaped and easy to fatten ; the average weight of each cow which varied from 992 to 1 047 lbs. 10 to 15 years ago, is now 1 272 lbs. The yield of milk has also gone up from 600 to 620 galls. in 1906 to 700 galls. in 1913. The stock is grazed on the parish land for the first year, for the second year on the Simmenthaler pasture in the Oberlahn district.

The holding supported an average of 18 pigs, with a live weight of 89 to 112 lbs. per acre. Breeding has been given up and animals bought at 6 weeks are fattened and sold at 6 months.

*Public woodland.* — The public woodlands, which occupy about 1000 acres, are on deep sandy soil ; their net yield per acre only reaches 3.*s.* A century ago, one eighth part of these woods was pasture, but the forest department objected to their restoration to their old state.

*Labour.* — By comparison with the Eastern provinces, the district of Wiesbaden, thanks to its small holdings, is particularly well off with regard to labour. It took only 835 out of 367 364 foreign labourers employed by German agriculture, whose importation was approved by the " Deutsche Arbeitzentrale " for 1912-13.

With regard to the transfer of rural property, it should be noted that a peasant takes over this father's holding when he is about 35 years old. The father can still look after the stock and the mother manage the home. Often one or two of the brothers or sisters of the young holder are unmarried and help him as paid workers. Otherwise he hires a labourer or woman worker. The children of the holder also help on the holding. After some years hired labour can be replaced by that of his grown up children. The holder enlarges his farm by buying or renting new plots ; he saves money or pays off his debts. Between 24 and 26 the eldest son marries and settles

down with his wife in the parental home. The old people continue to manage the holding for some years. The young wife brings as her dowry some land and often a little money. These plots are worked along with the parents' holding to the advantage of the young couple who thus begin at once to increase their property.

1116 - **Statistical Report on the Influence of Distance from Market on the Value of Rural Property in Missouri, U S. A.** — JOHNSON, O. R. in *Freeman's Farmer*, Vol. 70, No. 5, p. 11. North Jakina, Wash., May, 1916.

The statistical report, by the Missouri Agricultural Experiment Station, on 650 holdings in Johnson county, was designed to show within what limits distance from market affected the value of the holdings, and has given the following results :

| Class | Distance from market | Number of holdings per class | Mean value per acre |
|---|---|---|---|
| — | — | — | $ |
| I . . . . . | 2 miles | 79 | 78 |
| II . . . . . | 4 » | 183 | 70 |
| III . . . . . | 6 » | 126 | 61 |
| IV . . . . . | 8 » | 113 | 55 |
| V . . . . . | 10 » | 149 | 56 |

| Class | Value of holding per acre | Number of holdings per class | Distance from market |
|---|---|---|---|
| — | $ | — | miles |
| I . . . . . | more than 100 | 42 | 2,5 |
| II . . . . . | 80-100 | 62 | 3,0 |
| III . . . . . | 60- 80 | 275 | 5,0 |
| IV . . . . . | 40- 60 | 246 | 6,2 |
| V . . . . . | less than 40 | 25 | 5,5 |

The low unit value of the 25 holdings in group V is largely due to the poor quality of the soil ; this factor is here more important, in fixing the value, than distance from market.

## AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

1117 - **The Use of Cider Apples and Cane Sugar in a Beet Sugar Distillery.** — GAILLARD, E. in *Comptes Rendus de l'Académie d'Agriculture de France*, Vol. II. No. 24, pp. 676-681 Paris, 1916.

At the beet sugar distillery of Oisement, in the department of the Somme, experiments were carried out on the mixing of cider apples and cane sugar with sugar beet, or sugar beet molasses.

The apples were treated in two ways ; they were either mixed with sugar beets in the washing machine and then cut into the usual long narrow slices and handled as beets, or they were put into the diffusion cylinders alone in the form of thin flat slices $^1/_6$ in. thick. As apples contain very little

yeast food a certain number of the diffusion cylinders were charged with beet and each day some juice was withdrawn from them and added together with nutrient salts to the apple slices in order to assist fermentation. The yield of alcohol from the apples was taken as the difference between the total yield and that of the added beet juice. It amounted to not quite 10 gallons of rectified alcohol (100°) (rectified spirit and fusel oil) per ton of apples. It should be borne in mind that the experiment was carried out at the end of December 1915 and during the month of January 1916, or in other words at a season when the sugar content of apples was daily decreasing.

In the case of cane sugar, a starter was prepared at the outset, using a solution of beet molasses of a density of 1.055 to 1.060 and containing 2.4 to 2.5 gms. of acid per litre (expressed as sulphuric acid). To this, nutrient salts were added at the rate of 0.5 per cent of sulphate of ammonia and 0.6 of phosphate of soda. The starter was inoculated with yeast obtained from a grain distillery and fermentation was kept active by aeration. For the experiments, large vats of about 5000 gallons capacity were used and these were one third filled with starter. The cane sugar juice acidified till it contained 0.7 to 0.8 gm. of acid per litre, was then run into the vats on the top of the starter, the proportion of cane to beet sugar rising very gradually from 4 :20 to 80 :20. It was found that 18.3 lbs. of cane sugar were required to produce 1 gallon of rectified alcohol (rectified spirit and fusel oil). The cane used had a polarisation value of 92.

1118 - **Refraction Constants of Various Vegetable Fats and Oils.** — HEIM, F. in *Bulletin de l'Office colonial*, Vol. IX, No. 102-103, pp. 267-276. Melun, 1916.

A number of vegetable fats and oils originating from the French colonies were examined at the French Colonial Office with a view to determining the relationship, if any, between their refractive indices and other constants in common use, and their chemical composition.

The samples were ground in a mill and extracted in the cold with benzine which was afterwards distilled off in a warm bath, the residue being finally raised to 100° C. to drive off any remaining traces of benzine. Fats or oils thus obtained were filtered before having their refractive indices determined in a Fery refractometer. The results are set out in the adjoining table, and the writer draws the following conclusions :

1) The determination of the index of refraction yielded a very reliable means of estimating the chemical purity of any fat or oil. For instance the oil of *Thea sinensis* gave a refractive index of 1.4707 to TSUJIMOTO in Japan, and an index of 1.4706 in the present investigations. Other constants showed far greater variation more especially those resulting from chemical tests ; it would therefore appear that the measurement of physical characters is a much more accurate guide to the purity of fats and oils than is that of the chemical characters.

2) Except in the case of *Ricinodendron africanus* the index of refraction always varied with the iodine value.

3) As a rule the index of refraction increased as the saponification

*Composition and Consta*

| Oil seed | Botanical family | Fat constants | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Density | Melting point | Acid value | Saponification value | Reichert value | Hehner value | Iodine value | Index of refractic |
| | | | °C | | | | | | |
| "Karité" *Butyrospermum Parkii* Kotschi | Sapotaceae | 0.900 (32°) | 32° | 7.7 | 196 | 1.1 | 95.25 | 69.6 | 1.4654 (32) |
| | | 0.917 (15°) | Solidif. 17-18° | — | 192 | — | — | 67.2 | — |
| *Dumoria Heckeli* A. Chev. | Id. | 0.956 (15°) | 34° | 5.6 | 188 | 0.8 | 96.8 | 56.4 | 1.4606 (30) |
| *Ricinodendron Africanus* Muell. Arg. | Euphorbiaceae | 0.937 (15°) | 20° | 16.8 | 185 | 1.5 | 93 | 87.6 | 1.5034 (32) |
| *Hevea Brasiliensis* Muell. Arg. | Id. | 0.930 (15°) | 26° | 57.4 | 206 | — | — | 128.3 | — |
| | | 0.924 (15°) | — | 29.9 | 185.6 | 0.5 | 96.4 | 133.3 | 1.4698 (30) |
| *Symphonia lævis* | Clusiaceae | 0.872 (20°) | 15–16° | 8.4 | 189 | 1.65 | 94.3 | 66.7 | 1.4648 (28) |
| *Symphonia Louveli* | Id. | 0.879 (20°) | 15–16° | 8.4 | 189 | 1.65 | 94.1 | 67.6 | 1.4645 (29) |
| *Carapa microcarpa* A. Chev. | Meliaceae | 0.895 (15°) | 16° | 8.4 | 188 | 3.3 | 92 | 58 | 1.4677 (28) |
| *Sacoglottis Gabonensis* Urb. | Humiriaceae | 0.900 (15°) | — 2° | — | 188 | 5.5 | — | 85.8 | 1.4707 (17) |
| *Pentadesma butyracea* Sabine | Clusiaceae | 0.899 (15°) | 32° | 16 | 193 | 0.3 | 95.2 | 68.5 | 1.4590 (35) |
| *Balanttes Thieghemi* | Simarubaceae | 0.908 (15°) | liq. | 9.4 | — | 6 | 92.5 | 121 | 1.4737 (17) |
| "Aouara" (pericarp) *Astrocaryum vulgare* Mart. | Palmaceae | 0.916 (15°) | — | 31.4 | 196.8 | — | — | 75.2 | — |
| | | 0.887 (19°) | — | — | 184 | — | — | — | 1.4618 (29) |
| Idem (kernels). | Id. | — | 29°3 | 9.6 | 242.9 | — | — | 10.7 | 1.4563 (31) |
| | | 0.915 (17°) | 30° | — | 214 | — | — | 9.6 | — |
| *Thea Sinensis* Linn. | Cameliaceae | 0.910 (15°) | liq. | 7.5 | 176.6 | 15.5 | 86.5 | 72.6 | 1.4717 (16) |
| | | 0.917 (15°) | Solidif. 10° | 0.74 | 191.9 | 0.66 | — | 90.4 | 1.4707 (20) |
| *Funtumia elastica* Stapf. | Apocynaceae | 0.929 (15°) | liq. | 1.8 | 167.6 | 12.1 | 94 | 139 | 1.4798 (17) |
| *Sorindeta oleosa* | Anacardiaceae | 0.889 (17°) | 16–17° | 4.9 | 185 | 7.92 | 91.75 | 132 | 1.4682 (26) |
| "I'Sano" *Ongokea Gore* Pierre | Olacaceae | 0.973 (23°) | < — 15° | 4.7 | 206.4 | 33.5 | 93 | — | 1.5143 (17) |
| "Moabi" *Mimusops obovata* Pierre | Sapotaceae | 0.894 (30°) | 32–33° | 56 | 238.0 | 11.5 | 88.25 | 57.1 | 1.4638 (29) |
| *Chrysophyllum Congoense* | Id. | 0.870 (15°) | 31° | 68.5 | 175.7 | 1.76 | 95 | 49.9 | 1.4671 (22) |

*Various Vegetables Fats and Oils.*

| Melting point of fatty acids | fatty acids | | Nature of fatty acids | | Remarks | Authorities consulted for chemical properties of fats and oils |
|---|---|---|---|---|---|---|
| | saturated | unsaturated | saturated | unsaturated | | |
| | Per cent. | Per cent. | | | | |
| 51° | 67 | 33 | palmitic, stearic, arachidic | oleic | yellowish-white | Hébert |
| 56° | — | — | — | — | — | Various |
| 60° | 67 | 33 | palmitic, stearic, cerotic | oleic | yellowish-white | Hébert |
| 43° | 30 | 70 | myristic, palmitic | oleic, linoleic | yellow | Hébert |
| — | — | — | — | — | brown | Imp. Inst. |
| — | — | — | stearic | oleic, linoleic, linoleic | — | Imp. Ist. |
| 42°.5 | 40 | 60 | capric, lauric, margaric, arachidic | oleic | yellow | Hébert |
| 43° | 35 | 65 | capric, lauric, margaric, arachidic | oleic | yellow | Hébert |
| 28° | 45 | 55 | myristic, stearic, palmitic | oleic | yellow | Hébert |
| — | — | — | — | — | yellow | Hébert |
| 60° | 90 | 10 | palmitic, stearic | oleic | yellowish-white | Hébert |
| 35° | 37 | 63 | — | — | yellow | Hébert |
| 32°.2 | — | — | — | — | dark brown | Bontoux |
| 34° | — | — | — | — | dark brown | Hébert |
| — | — | — | — | — | yellowish-white | Bontoux |
| 24° | — | — | — | — | yellowish-white | Hébert |
| 36° | 42 | 58 | capric, lauric | oleic | yellow | Hébert |
| 33°.5 | — | — | — | — | — | Tsujimoto |
| 27° | 40 | 60 | lauric, myristic, margaric | oleic | yellow | Hébert |
| 39–40° | 76 | 24 | inferior acids | oleic | brown | Hébert |
| liq. | 0 | 100 | none | oleic 15 %, linoleic 75 %, isanic 10 % | Impossible to determine; Iodine value, very large. dark brown | Hébert |
| 45–46° | 50 | 50 | myristic, stearic, palmitic | oleic | yellow | Hébert |
| 40° | 50 | 50 | lauric, myristic, palmitic | oleic | red brown | Hébert |

value decreased. Exceptions to this rule were the oil of " I Sano " and the fat of *Ricinodendron africanus.*

4) No relationship could be traced between the index of refraction and the remaining constants, *i. e.* acidity value, Reichert and Hehner numbers.

5) With regard to the influence of the chemical composition on the index of refraction, it is obvious that the value of the latter must be dependant on the actual constitution of the fat or oil. Inasmuch as each fat or oil consists of mixture of the fatty acids or of the glycerides of the fatty acids, the refractive index of the whole substance must be influenced by the refractive indices of its component parts.

If the fat or oil be a true mixture and the optical characters of each of its constituents were known it should be possible to calculate either its refractive index from a quantitative chemical analysis or *vice versa.* But up to the present no other refractive indices beyond those of stearic, palmitic and oleic acids have been determined and the indices of all the glycerides have still to be investigated. Under these conditions it is very difficult to say with any degree of certainty whether fats and oils really consist of true mixtures and whether it will ever be possible to check experimental results by calculated values. The only example at present available in this connection is the fat of *Pentadesma butyracea* which consists of 90 per cent of stearic and palmitic acids with 10 per cent of oleic acid. Its refractive index works out to 0.512 at 79° C. ; practical tests gave 0.530.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

1119 – **The Grading of Milk.** — KELLY, E. in *Hoard's Dairyman*, Vol. LII, No. 1, pp. 1 and 6. Fort Atkinson, Wis., July 28, 1916.

The grading of milk is made necessary by the fact that it costs more to produce milk of one quality than of another, and that the producer ought to be paid accordingly. A first attempt to sell a very pure milk in the United States was made about 25 years ago when a " certified " milk was put on the market in New Jersey. This was intended for infants and invalids and was produced under strict medical supervision and at a great expense. Since then several health departments have granted permits for the sale of " inspected " milk which is not of such high quality as the certified milk, but still considerably better than the average supply. Such inspected milk usually fetches one or two cents per quart over and above the current price.

Grading may be done either by the milk dealer from purely business motives, or by the town or state officials for the benefit of the consumers. Three principal factors determine the quality of the milk, *i. e.* its fat content, the number of bacteria it contains, and the sanitary condition of the dairy farm where it has been produced. Some dealers grade milk on the fat content alone, others only on the standard of the cleanliness at the dairy farm, while a few health authorities simply use the bacterial counts.

As an example of payment for graded milk : one large dairy company buys on a schedule in which prices are quoted for each month and for milk with a fat content ranging from 3 to 4.2 per cent. During the six winter months a difference of 4 cents per point is made for each 100 lbs. of milk ; in summer the difference is 3 cents per point. This amounts to 40 cents

a pound for butterfat in winter and 30 cents in summer. If the milk contains less than 8.5 per cent of solids non fat, 2 cents per 100 lbs. of milk are deducted for every point below the standard. There are also other deductions made as follows : 5 cents per 100 lbs. of milk if it is received at a temperature above 60° F. ; 5 cents per 100 lbs. if it contains more than one million bacteria per cc. ; and 2 cents per 100 lbs. if the condition of the home dairy is not satisfactory.

As an example of grading by health authorities, New York City and Newark N. J. recognise four qualities of milk : *A* raw and pasteurised ; *B* pasteurised ; *C* to be sold only for cooking. Daily sales for New York City are divided as follows :

| | | | | | |
|---|---|---|---|---|---|
| 50 000 | quarts of grade | *A* | (raw) | at 12 to 22 | cents per quart |
| 145 000 | " " " | *A* | (pasteurised) | 10 to 11 | " " " |
| 2 305 000 | " " " | *B* | " | 9 | " " " |

The main requirements for each grade are set out in the adjoining table.

*Grades of Milk Sold in New York City.*

| Grade | Healt of cattle | No. of bacteria | | No. of marks for conditions under which milk is produced | Temp. | Age at delivery | Remarks |
|---|---|---|---|---|---|---|---|
| | | Before pasteurisation | At time of delivery | | | | |
| *A* raw | Tuberculin test and general examination | — | 60 000 | Equipment. 25<br>Methods . . 50 | 50° F | Not more than 36 hours | — |
| *A* pasteurised | General examination | 200 000 | 30 000 | Equipment. 25<br>Methods . . 43 | 50° F | 36 hours after pasteurisation | — |
| *B* pasteurised | » » | 1 500 000 (1) | 100 000 | Equipment. 20<br>Methods . . 35 | 50° F | » » | — |
| *C* for cooking | » » | 300 000 (2) | 300 000 | 40 | 50° F | 48 hours after pasteurisation | Sold only in cans |

(1) Pasteurised in the city.
(2) Pasteurised outside the city.

1120 - **Pasteurization of Milk in the Bottle.** — In *Pure Products* Vol. XII, No. 8, pp. 385-392. New-York, August, 1916.

There are at present three methods by which milk is pasteurized : The " flash " or continuous method ; the " holder " or intermittent method, and the method of pasteurizing in bottles which is the latest device for the pasteurization of milk.

In the " flash " process milk is heated at 160° to 165° F. for 30 to 60 seconds. This process has the disadvantage that the milk is often heated too high or is scorched, causing the milk to have a peculiar and unpalatable taste. In the " holder " process milk is heated to and kept at 140° F.to 145° F. for 30 minutes. The pasteurized milk should then be cooled and kept at a temperature below 50° F. The " holder " process, in which compartments or tanks are employed, does not give a uniformly pasteurized product since the large volume of milk makes it impossible to heat it uniformly, one corner or section of the tank being always hotter or colder as the case may be. The tank being necessarily divided into compartments or sections, pockets are created making a positive circulation of milk and therefore a uniformity of temperature in the entire vat or compartments impossible. At any rate in both of these methods — the " flash " and the " holder " process — a recontamination, while filling the milk into bottles cannot be avoided. The third method avoids the risk of recontamination, as the milk is first bottled and then pasteurized.

Pasteurization of milk is frequently done very inefficiently, usually owing to ignorance or carelessness. When the heat applied is insufficient either in amount or time of application, disease germs are not all destroyed and as a consequence epidemics of streptococci, sore throat, typhoid fever, etc., have started. In order to obtain a uniform product it is essential that not only the pasteurization process must be given the proper attention but that proper and efficient devices must be applied in the soaking and rinsing of the bottles. It is useless to apply the most complete pasteurizing outfit if the bottles into which the milk is to be filled are not cleaned properly, and, on the other hand, it is insufficient to use a clean bottle if the pasteurization process is incomplete. The Barry-Wehmiller System of *soaking*, washing and rinsing of the bottles, clarifying of the milk, filling and pasteurizing of the filled bottles is said to be the " last word " in the production of a safe milk. A short description of this model plant may serve to give an idea of the arrangement and machinery used.

As soon as the full cans are received from the wagons they are immediately poured through a *screened* receiving pan from which the milk flows into two 2 000 gallon Pfaudler Glass-Lined Receiving Tanks.

The tanks are lined with glass enamel on the interior and the inner shell provided with an outer jacket. Within this jacket circulates brine, which keeps the milk cold. The jacket is insulated externally with cork blocks. At the bottom of the tanks are perforated air pipes through which washed and filtered air is supplied under pressure from the aerator and compressor. The action of this forced air keeps the milk in complete and constant agitation.

The milk kept in tanks is in contact with a much smaller surface than if kept in cans. The surface which 2,000 gallons of milk come in contact with if kept in 200 cans of ten gallons each represents 1.100 square feet whereas if milk is stored in a Pfaudler tank holding 2.000 gallons, it is in contact with but 110 square feet, or just one-tenth of the surface. In other words, by eliminating can storage the surface is reduced 90 per cent. The more surface the milk comes in contact with, and the longer the milk is kept, the higher the chances of an accumulation of bacteria.

When ready for filling, the milk flows from these tanks into a milk pump which forces it to the floor above through a clarifier, thence direct to the bottle filler.

The empty bottle cases are unloaded from the wagons and delivered by a *gravity conveyor* directly in front of the *soaking machine.* The bottles are taken out of the cases and put into the *pockets* of the soaker. The empty cases, after being cleaned, are deposited on a gravity conveyor which carries them to the discharge end of the pasteurizing machine ready to be refilled with pasteurized milk.

Now the bottles pass mechanically through the soaker which consists of a large tank divided into from 3 to 6 compartments, all of which, except the last, are filled with hot water and caustic soda solution. The first compartment of the soaker contains the strongest solution of caustic soda at a temperature of 110°. The following compartments contain solutions of less strength at temperatures as high as 180°. The last compartment is kept filled with fresh water at a temperature of 80°.

The bottles are passed successively through these various compartments, occupying a total time of 20 minutes for the entire process.

After passing through this soaking system, the bottles are delivered mechanically to the outside pressure washing machine, where the outside of the bottles are washed by jets of water under pressure, and the inside is filled with water at the same time, which frees them from the caustic soda solution to which they have previously been subjected. The bottles are then passed mechanically to the large inside pressure washing machine in which they are thoroughly cleaned, each bottle being subjected to five successive washings in the inside. Three of these five washings are by means of water circulated under pressure by a centrifugal pump at 65 pounds per square pressure by a centrifugal pump at 65 pounds per square inch. The final two washings are performed by water directly from the fresh water supply. The water used in these final washings is the only water actually consumed as all the other water is reused.

During this process of interior washing, the bottles are once more washed externally by jets directly from above, which jets are also connected with a pump and supplied by reused water. The greatest efficiency is therefore, obtained with a minimum amount of fresh water expense.

After the final washing, the bottles are delivered mechanically on a brass platform from which they go to the filler.

The filler passes them in a circular direction and fills the bottles at the

rate of from 60 to 90 bottles a minute. Each bottle is filled to a definite line, which can be altered as required.

When filled, the bottles move mechanically to the crowning machine and are capped continuously with seals. The only labour required in this process is to keep the machines supplied with *crowns*.

When this capping process is completed, the work of bottling is considered 90 per cent, finished, as the only remaining work required is to place the bottles by hand into the baskets of the pasteurizing machine.

The pasteurizing process is entirely mechanical and requires one hour and twenty minutes, During this time the bottles are submerged slowly and continuously through the various compartments, bringing the temperature of milk gradually up to 145°. The bottles then are slowly passed through water of this temperature for 25 minutes. After this treatment the bottles continue on their journey through water of gradually decreasing temperature until they finally reach ice-cold water, the passage through which takes 15 minutes. They emerge at the discharge end of the pasteurizer at a temperature of 36°.

The delivery of pasteurized and cooled milk is continuous and is going on all the time the baskets are being loaded from the crowning machine.

The bottles are now taken out of the baskets of the pasteurizer and placed in the original cases which have been delivered as previously described. The filled cases are placed on a *gravity conveyor* which delivers them mechanically into the refrigerating room where they remain until required.

The various sections of the pasteurizer are thoroughly insulated with cork for the cold sections, and asbestos for the hot sections thus preventing radiation of heat and cold and securing maximum efficiency of the apparatus.

The motive power required for running the machines is as follows: The combined soaker and washer is handled by a 6 horse-power motor; the filler and crowning machine each require a ½ horse motor. The large pasteurizing machine is operated by a half horse motor. All these machines are large enough to handle 4 000 quart bottles per hour. The number of operators required for the entire system may be conservatively estimated at six.

The cost of operating this system is as follows: Six men at 15 cents per hour, 90 cents, or 22 ½ cents, per 1000 bottles. Steam and refrigeration, according to records since January 1st, amounted to 75 cents per 1000 quart bottles: crowns for small neck bottles, 80 cents per 1000. This is a total of $ 1.77 per 1000 quart bottles.

This plant of the Steinlage Sanitary Milk Co. is of unusual interest because it marks the beginning of a new application of pasteurization to the milk trade. It is the first milk plant in the United States to adopt the system in its entirety, including the small neck bottles. The Steinlage bottles are the same style as used for grape juice.

The pasteurization of milk in bottles must be considered a progressive

step because the principle applied is a perfect one and the results are uniform and positive.

1121 – **Digestibility of Very Young Veal** (1). — Langworthy, C. F. and Holmes, A. D. in *Journal of Agricultural Research*, Vol. VI, No. 16, pp. 577-588. Washington D. C., July 17, 1916.

The sale of calves aged less than 3 to 6 days is prohibited in the United States by Federal and State laws. Yet in regions where the dairy industry is highly developed, milk is such an important product that it is not thought profitable to rear calves beyond the period when the mother's milk becomes saleable, and so, even though they cannot be marketed as butcher's meat they are often slaughtered at 3 to 6 days old.

The prejudice against young veal is inspired chiefly by a belief that it is indigestible and may cause physiological disturbances. In order to determine how far this belief is founded on fact, various investigators have compared the meat of very young calves with that of more mature calves, both in respect to their chemical composition and their digestibility. On the whole the balance of evidence goes to prove that very young veal is not unsuited to use as human food. As very little information, however, is available as regards the co-efficient of digestibility of very young veal, a series of experiments was undertaken, to determine the completeness of digestion of this material by the human subject in normal health.

Five active young men were selected as the subjects of the experiments. An average of 237 gms. of meat (from calves not more than 5 days old), furnishing 78 gms. of protein or 75 per cent of the total protein of the diet, was eaten daily by each man. The results showed that the digestibility of total protein and that of the meat protein alone were practically identical (92.9 and 92.7 per cent).

The experiments were repeated with the same subjects, but using market veal in the place of the very young veal. The digestibility of the protein in the total diet was again 92.9 while that of the meat was 92.8. In other words very young veal and market veal were found to be equally digestible. No physiological disturbance of any kind were experienced by the subjects either during the experimental period or afterwards.

1122 – **Disadvantage of Selling Cotton in the Seed.** — Cresswell, C. F. *United States Department of Agriculture, Bulletin* No. 375, pp. 1-18. Washington, D. C. August 9, 1916.

AGRICULTURAL PRODUCTS : PRESERVING, PACKING, TRANSPORT, TRADE

The practice of selling cotton in the seed, though less prevalent than formerly, is still fairly common in the United States. In regions where the crop is not grown in sufficient quantities to attract regular buyers, the producer is thereby enabled to raise cash on his harvest more quickly than he would by the sale of ginned cotton. As a matter of fact, the advantage is a small one and only amounts to the saving of the time he spends in waiting his turn at the gins. Baled cotton being saleable directly to merchants and liable to make the farmer independent of the middleman, ginners do not encourage the sale of ginned cotton, more especially as in

(1) See also *B.* April 1916. No. 455.

buying cotton in the seed, they take into account the speculative nature of the business and generally manage to secure a profit in addition to their regular ginning charge. According to the figures of the Bureau of Crop Estimates 8 to 9 per cent of the total cotton crop in the United States is sold in the seed, while the amounts in Virginia and Missouri rise to 60 and 90 per cent respectively.

In order to obtain reliable information as to the relative advantages of the two methods of marketing, an investigation was carried out in Oklahama during the season 1913-14. Every week a number of samples of seed cotton were collected in representative markets. Each sample weighed 10 lbs. and with it was secured a record of the seller's name, the date, place of sale, and price per 100 lbs. The samples were all sent to Washington where they were ginned and carefully graded.

For the purpose of comparing the returns obtained by marketing the cotton before ginning, with its real value as determined by the ginning, the price paid for seed cotton was converted into its equivalent price per baled lint as follows:

Taking as an illustration a load of seed cotton which was sold at $4 per 100 lbs. and which on being ginned yielded:

| | | | | |
|---|---|---|---|---|
| 30 | per | cent | of | lint |
| 68 | " | " | " | seed |
| 2 | " | " | " | trash |

| | | | |
|---|---|---|---|
| Lint used for bagging and tying at the rate of 22 lbs. per 478 lbs. (rated at the same price as the other lint sold) | = | 1.38 lbs. | |
| Therefore total weight of lint sold | = | 31.38 lbs. | |
| Value of seed at $ 20 a ton | = | $ 0.68 | |
| Therefore payment for lint | = | $ 3,32 | |
| Ginning and baling charge at $ 0.070 per 100 lbs. | = | $ 0.22 | |
| Therefore total cost to buyer of 31.38 lbs. of lint | = | $ 3.54 | |
| Cost of 1 lb. of lint or " equivalent lint price " | = | $ 11.28 | cents. |

By tabulating these " equivalent lint prices ", wide variations were found to exist between the prices received for the same quality of lint in the same market and during the same week. This amounted in one instance to as much as 5.21 cents per pound or $26.05 per bale. Moreover it commonly occurred that lint of low quality brought in more money than lint of higher quality.

The fact that the proportion which lint, seed and trash bear to one another varies considerably in different samples and that it is impossible to estimate with any degree of accuracy either the value of these proportions or the quality of the lint before the cotton is ginned makes it impossible to fix a fair price for cotton when sold in the seed. Such a method of marketing is unsatisfactory to both buyer and seller. In some instances the producer will receive more for his crop in the seed than he would in the bale, but in the large majority of cases he loses. Both farmer and ginner are advised for the common good of all to make ginning customary, so that it may be possible to sell each bale on its individual merits.

1123 – **Tendency Towards a Levelling of Prices for Fresh and Frozen Meat.** — SAGNIER, H. in *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. II. No. 16, pp. 477-481. Paris 1916.

The subject of frozen meat has been under discussion at the " Académie d'Agriculture " on previous occasions and a report has been made by TISSERAND on the progress of the industry in England. In the month of February of the present year (1916) the English Board of Agriculture published the returns for the imports of frozen meat into England during 1915. These show a considerable rise on those for 1914 owing to the fact that large quantities of meat were reexported to France. Imports of beef rose from 200 000 tons in 1914 to 300 000 in 1915 while the values increased from £ 8 735 000 to £ 17 798 000 showing a marked upward tendency in prices. So strong is this tendency that the difference in price between fresh and frozen meat is gradually being eliminated. Frozen beef which sold for $4\,{}^{3}/_{4}d$ per lb. in 1914 was worth $6\,{}^{1}/_{2}d$ in 1915 (40 per cent increase) and in the course of that year rose to $6\,{}^{3}/_{4}d$ and reached $7\,{}^{3}/_{4}d$ per lb. in January 1916;

Mutton has passed through much the same changes, though the total imports are smaller than those of beef. Frozen mutton rose from $4\,{}^{3}/_{4}d$ per lb. in 1914 to $6\,{}^{1}/_{2}d$ per lb. in 1915 (or an increase of 50 per cent). Frozen mutton which came chiefly from Holland made a lower price than the frozen meat, the average price for 1914-15 being $5\,{}^{1}/_{2}d$ per lb.

# PLANT DISEASES

## DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1124 – **Investigations on the Formation of Cracks in Potato Tubers.** — ZIMMERMANN, H., in *Zeitschrift für Pflanzenkrankheiten*, Vol. 26, Fasc. 5, pp. 280-285, Stuttgart, July 30, 1916.

In this paper the author gives an account of the investigations carried out during the years 1906-1915 by the section of plant diseases at the Rostock Agricultural Experimental Station, concerning the formation of internal cracks in potato tubers. The results of these very detailed experiments can be summarised as follows :

The cracks are formed in places where the fields have received too much nitrogenous manure. Owing to the low degree of starch formation the middle tissue of the tuber is poor in starch and transparent in sections. This central tissue is naturally not rich in starch, and the formation of cracks in this region is probably correlated with the lack of starch and is caused by the characteristic growth which is encouraged in the tubers by too exclusive a treatment with nitrogenous manure. The cracks nearly always begin in the middle of the tuber ; when they extend to the outside, the potato is rotten inside owing to the inroads of bacteria.

Often the middle of the tuber is discoloured and lumps of tissue are found instead of the cracks. Sometimes also the darkening of the central region is replaced by a brown zone extending inwards from the point of attachment of the stalk and stretching along the vessels, a feature which is also seen in the potato disease known as " Ringkrankheit ".

The manures that chiefly encourage the appearance of these phenomena are : Chili saltpetre, farmyard manure, and serradilla used as a green manure. It is stated that up to the present time the disease has only appeared in light soils.

According to the author the disease is by origin related to the " Eisen- (Bunt-) fleckigkeit " and the " Kringerigheit " of tubers. It would be necessary to experiment further before deciding whether metereological conditions play the same part.

The cracks are not only found in the tubers of potatoes, but also in the roots of mangold-wurzels, swedes and turnips. Probably they also originate from too much nitrogen.

## DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

1125 – **The Physiological Races of *Erysiphe graminis* on Wheat and Oats.** — GENERALITIES.
REED, M. G., in *University of Missouri, Research Bulletin* No. 23, pp. 1-19. Columbia, Missouri, 1916.

From the results of MARCHAL, SALMON, and the author's works the morphological species *Erysiphe graminis* D. C. ("blanc des céréales") should be made up of a considerable number of physiological races, of which each develops on definite hosts and is for the most part connected with only one genus. Thus, for example *Erysiphe* of barley lives on species of the genus *Hordeum*, the *Erysiphe* of wheat on *Triticum*, that of rye, of oats, and of meadow-grass, on *Secale*, *Avena*, and *Poa* respectively. Sometimes it has been possible to note the passage of the parasite from one genus to another of the plant hosts. According to MARCHAL, the *Erysiphe* of oats can grow on *Arrhenatherum elatius* and the *Erysiphe* of wheat on *Hordeum sylvaticum* and on some species of *Aegilops*. However these cases are rare, for there is even, in nature, a tendency towards still greater specialization as well as towards physiological adaptation. SALMON'S work follows the same lines, the *Erysiphe* of barley cannot attack all the species of *Hordeum*. *H. jubatum*, *H. murinum* and *H. secalinum* are immune, while *H. bulbosum*, *H. deficiens*, *H. distichon*, *H. hexastichon*, *H. intermedium*, *H. maritimum*, *H. vulgare* and *H. zeocriton* are on the contrary very sensitive. Most of the varieties of *Triticum vulgare* are very susceptible to *Erysiphe*, while the three varieties *T. caesium*, *T. ferrugineum* and *T. pyrothrix* show a high power of resistance. In the present work the results of a long series of experiments are given relative to the physiological races of *Erysiphe graminis* in the genera *Avena* and *Triticum*. There is nothing in the experimental technique that is essentially new ,inoculations were made with a scalpel, but also large quantities of conidia were scattered on the leaves and stem of plants.

*Triticum* spp. — The behaviour of 161 species and varieties of *Triticum* has been studied. It is sufficient in this place to consult the subjoined table where the relation of the varieties of 8 species or types of *Triticum* to *E. graminis* is shown:

In 101 varieties the infection reaches its maximum, 100 per cent, these are varieties that are very susceptible to the attacks of *Erysiphe*. The slight diminution that is seen among the 14 varieties of the second group has no specific value. The simple fact that one trial has given a negative result while in all the others the fungus develops freely cannot certainly be interpreted as the beginning of immunity. The same thing can also

| Species or type of *Triticum* | Varieties | Percentage infections | | | | |
|---|---|---|---|---|---|---|
| | | 100 | 90-99 | 50-89 | 10-49 | 0-9 |
| *Triticum compactum* . . . . . | 6 | 2 | 1 | 2 | 1 | 0 |
| *T. dicoccum* . . . . . | 24 | 8 | 3 | 6 | 3 | 4 |
| *T. durum* . . . . . | 45 | 36 | 0 | 6 | 2 | 1 |
| *T. monococcum* . . . . . | 6 | 0 | 1 | 3 | 1 | 1 |
| *T. polonicum* . . . . . | 10 | 9 | 1 | 0 | 0 | 0 |
| *T. Spelta* . . . . . | 11 | 8 | 1 | 2 | 0 | 0 |
| *T. turgidum* . . . . . | 7 | 3 | 2 | 2 | 0 | 0 |
| *T. vulgare* . . . . . | 52 | 35 | 5 | 6 | 3 | 3 |
| Total . . . | 161 | 101 | 14 | 27 | 10 | 9 |

be said about the third group with its 27 varieties, especially in considering the numerous sources of error (conditions of temperature, moisture, technique, etc.) which often interfere with the results in this kind of work .

But when, everything else being equal, the results always tend to be negative, and when the percentage of infection falls below 50, it must be admitted that the case is different, and that the variety under examination is less susceptible than in those cases where artificial infection is almost always successful. The varieties *Triticum Fuchsii*, " Common Emmer ", " Russian Emmer ", " Spring Emmer ", " White Emmer ", and " Rhaphi " of *T. dicoccum* ; the varieties *T. durospermum*, *T. libycum* and " Malaga " of *T. durum* ; the variety *T. vulgare* of *T. monococcum* and the varieties *T. caesium*, *T. erythrospermum*, *T. ferrugineum*, and *T. pyrothrix* of *T. vulgare*, are undoubtedly all immune to a very great extent.

There are some results of special interest, those which have been obtained with the wild wheat of Palestine which is considered by many authors to be a distinct species (*T. dicoccoides* Kcke.) and by others as a variety of *T. dicoccum*. This type of wheat should be very susceptible to the attacks of *Erysiphe*.

With the exception of several species of the genus *Aegilops* which is moreover often considered as a sub-genus of *Triticum*, all the attempts at infecting grasses of various genera, *Avena sativa*, *Brachypodium distachyum*, *Hordeum vulgare*, and *Secale cereale*, have given entirely negative results.

*Avena* spp. — 41 varieties belonging to 17 species of oats have been examined, and, with the exception of *A. bromoides* Gouan. and of *A. sempervirens* Vill. which show a marked degree of resistance, all the varieties are shown to be very susceptible. The *Erysiphe* of oats can also develop on *Arrhenatherum avenaceum* Beauw. The proportion of infection is 14 per cent. The parasite cannot however infect barley or wheat.

The author's work gives many experimental proofs of the existence

and nature of physiological races in *Erysiphe graminis*, and further shows that the degree of susceptibility of the various varieties and species differs considerably, for it is possible in a limited number of cases to give rise to a perfectly immune condition. In such a case, the inoculation of conidia from the parasite produces no effect, or, at the most, it causes little discoloured patches to appear on the foliar limbs. In the susceptible varieties the mycelium develops 2 or 3 days after inoculation in obvious patches which join together often to the extent of covering the leaves and stems with a continuous layer of mycelium; on this layer conidia soon appear in considerable quantities.

1126 – **Experiments on the Wintering of the Teleutospores of "rust" in Grasses.** — KLEBAHN, H., in *Zeitschrift für Pflanzenkrankheiten*, Vol 26, Fasc. 5, pp pp 272-277, Stuttgart, July 30, 1916.

These experiments were carried out to determine if the teleutospores retain the power of germinating after wintering in the earth. To this end, haulms of *Agropyrum repens* Beauv. and leaves of *Phragmites communis* were kept in pots, the plants having been attacked by *Puccinia graminis* Pers. and *P. Phragmitis* respectively. The pots were partly filled with sand and partly with garden earth, and were kept through the winter in the open. Teleutospores were also kept in a pot without a covering of soil for comparison.

On March 30 the cultures of teleutospores were raised and dried. In the control made about April 15 the teleutospores kept under soil or sand had germinated better than those kept in the air. The cultures raised on April 30 germinated equally well (May 8). The pots were left in the open until the end of April, then they were placed in the glass-house, but without watering. On May 25 when other cultures were taken up, the soil of the pot was still damp; in *P. graminis* the power of germination was good, in *P. Phragmitis* it had suffered a little.

In conclusion, the teleutospores of " rust " in grasses, that have been wintered in the earth, germinate in the following spring at least as well as those that have been exposed to the air. From which it follows that, in practice, the haulms of attacked cereals after wintering in the earth, in the next spring can reinfect the host of the aecides though not the cereal itself.

1127 – **Breeding Experiments with a View to Obtaining a *Helianthus* Resistant to "rust" (*Puccinia Helianthi*).** — See number 1072 of this *Bulletin*. RESISTANT PLANTS.

1128 – **Mildew of Cereals (*Sclerospora macrospora*) in Spain** (1). — ARROPHELES, in *El Cultivador Moderno*, Vol. VI, No. 4, 1 fig. pp. 4, Barcelona, 1916. DISEASES OF VARIOUS CROPS

In the province of Huesca (Aragon), the wheat harvest of 1915 suffered a loss of at least 40 per cent. This loss has been attributed to an attack of " mildew ".

The parasite has not so far been recorded on rice in Spain.

(1) See *B.* Oct. 1915, No. 1096 and *B.* Dec. 1915, No. 1346. (*Ed.*).

1129 - **Effect of Certain Species of *Fusarium* on the Composition of the Potato Tuber.** — HAWKINS, L. A. in the *Journal of Agricultural Research*, Vol. VI, No. 5, pp. 183-196. Washington, D. C., 1916.

Potato tubers are subject to the attacks of various parasitic fungi. Some of these invade the tuber, kill the cells, break down the cell walls, and cause, directly or indirectly, a more or less complete disorganisation of the host tissues. In the present paper the writer has given the result of a series of researches on the modifications that are produced in the potato by *Fusarium coeruleum* (Lib.) Sacc., *F. oxysporum* Schlecht and *F. radicicola* Wollenw. Each tuber is cut in four and each quarter is placed in a culture tube stoppered with sterile cotton wool. Of the four preparations, two act as control. This method gives results which are much more directly comparable than those that would be obtained if different tubers were used rather than parts of the same tuber, because the amount of sugar, starch and pentosan contained varies very much in different tubers. The most important conclusions can be summarised as follows :

TABLE I. — *Reducing Sugar and Sucrose Content of the Sound and Rotted Quarters of Potatoes. Expressed as percentages of the oaiginal wet weights*).

| Sp. of *Fusarium* and potato number | Reducing sugar | | Sucrose | |
|---|---|---|---|---|
| | rotted quarter | sound quarter | rotted quarter | sound quarter |
| *Fusarium oxysporum* . . 160 | 0.04 | 0.31 | 0.10 | 0.66 |
| » . . . . . 159 | 0.04 | 0.28 | 0 | 0.67 |
| » . . . . . 158 | 0 | 0.44 | 0 | 1.03 |
| *F. coeruleum* . . . . . 149 | 0.13 | 0.40 | 0.12 | 0.39 |
| » . . . . . 150 | 0.04 | 0.47 | 0.24 | 0.50 |
| » . . . . . 151 | 0.17 | 0.37 | 0 | 0.66 |
| *F. radicicola* . . . . . 32 | 0 | 0.03 | 0.04 | 0.24 |
| » . . . . . 26 | 0 | 0.02 | 0.04 | 0.19 |
| » . . . . . 34 | 0 | 0.03 | 0.02 | 0.09 |
| » . . . . . 41 | 0 | 0.02 | 0 | 0.42 |

As is seen in the table all three species of *Fusarium* use the sugars which in most cases disappear almost completely. The fungi secrete two enzymes, sucrase and maltase, which hydrolized the saccarose and maltose. The effect of the fungi on the starch is in marked contrast to their action on the sugars. The amount of starch is undiminished, and there may even appear to be an increase due to the fact that the fungi build up material in the course of the examination. *Fusarium* consumes a considerable quantity of pentosans while leaving the methylpentosans untouched.

TABLE II. — *Pentosan and Methyl- Pentosan Content of Sound and Rotted Quarters of Potatoes (percentage of pentosans, wet weight).*

| Potato number | Sound quarter | | | Rotted quarter | | |
|---|---|---|---|---|---|---|
| | Total pentosans | Pentosans | Methyl pentosans | Total pentosans | Pentosans | Methyl pentosans |
| *F. oxysporum* . . . . . 29 | 0.53 | 0.47 | 0.06 | 0.50 | 0.35 | 0.15 |
| » . . . . . 30 | 0.53 | 0.41 | 0.12 | 0.46 | 0.35 | 0.11 |
| » . . . . . 35 | 0.45 | 0.36 | 0.09 | 0.44 | 0.35 | 0.09 |
| » . . . . . 40 | 0.52 | 0.42 | 0.10 | 0.37 | 0.26 | 0.11 |
| *F. radicicola* . . . . . 171 | 0.28 | 0.23 | 0.05 | 0.25 | 0.20 | 0.05 |
| » . . . . . 174 | 0.37 | 0.32 | 0.05 | 0.29 | 0.24 | 0.05 |
| » . . . . . 176 | 0.25 | 0.19 | 0.06 | 0.26 | 0.21 | 0.05 |

It should be noticed, on the other hand, that the fungi grown in potato extract produce as much pentosan as methylpentosan, so that the given quantities in the table represent the difference between the amount of pentosan destroyed and the amount built up by the fungi.

The crude fibre is a mixture of compounds, among which are some of the cell wall constituents, including cellulose. The distribution of the crude fibre is not as uniform as that of the pentosans. It is $3\,^1/_2$ to 5 times as abundant in the cortex as it is in the inner part of the tuber. Parasitic fungi raise the percentage of crude fibre a little, although the differences in question are always small.

The substances which give mucic acid when boiled with the proper concentration of nitric acid are considered in this paper as galactans. The effect of *Fusarium* on these substances is shown in the following table :

TABLE III. — *Galactan Content of Sound and Rotted Quarters of Potatoes.*

| Rotted with *Fusarium radicicola* | | | Rotted with *Fusarium oxysporum* | | |
|---|---|---|---|---|---|
| Potato number | Rotted quarter | Sound quarter | Potato number | Rotted quarter | Sound quarter |
| 27 | 0.039 | 0.062 | 166 | 0.069 | 0,071 |
| 31 | 0.033 | 0.060 | 167 | 0.068 | 0,076 |
| 42 | 0.029 | 0.030 | 172 | 0.081 | 0.083 |

All the species of *Fusarium* examined gave practically the same results. It is worthy of note that the grains of starch remain intact, while the monosaccharids and disaccharids are attacked by the fungi, although they

form a diastase which readily hydrolizes starch when it occurs in a gelatinous condition.

1130 – ***Fusarium radicicola*, the Cause of Rot in Potato Tubers in the United States.** — PRATT, O. A., in *The Journal of Agricultural Research*, Vol. VI, No. 9, pp. 297-309, Pl. XXXIV-XXXVII, Washington, D. C., 1916.

*Fusarium radicicola* Wollenw. gives rise to two distinct types of rot in potatoes : a dry rot and a soft or gelatinous rot.

Dry rot (" black rot ") is characterised by blackening of the attacked tissues, which in time always acquire a dark sepia-brown colour. The fungus invades the host by three channels : 1) the point of the branch where the swelling of the tuber begins (" stem-end ") ; 2) lenticels ; 3) eyes. In the first case the parasite develops and extends throught the vascular system which turns black and dies, in the second case it spreads more or less completely round the tissues ; finally, in the third case, it passes up the secondary vascular branches but scarcely ever reaches the central axis.

Externally, infected tubers have a sunken brownish-black region. This type of rot is, especially noticeable in potatoes with round tubers such as " Idaho Rural " and " Pearl ". In every case where infected material was isolated, *F. radicicola* and sometimes *F. oxysporum* as well were found. The latter should be considered as an occasional parasite, which gets into the tubers by the necrosed vascular bundles. When the spores of *F. radicicola* were injected into the tubers and stolons of the potato the results obtained were definitely positive ; after longer or shorter periods of time, which vary according to thermal conditions, the characteristic symptoms of " black rot " appeared.

In cases of soft rot (" jelly-end "), the fungus enters the tuber at the point of its formation and the infection spreads inwards ; although it spreads more quickly along the vascular bundles, it effects all the tissues to some extent. It is not long before the diseased parts become brown. This type of rot is found principally in potatoes with oval tubers, the Burbank group, for example " Netted Gem ". There is no doubt, judging from the positive results of inoculations, that *F. radicicola* is able to produce jelly-end rot. But in isolating the pathogenic germs from naturally infected material it could be proved in almost all cases that, in addition to *F. radicicola*, there were also present other species of *Fusarium* such as *F. trichothecioides* and *F. oxysporum*. The last, as shown by CARPENTER'S researchs, can give rise to a soft form of rot in tubers, and considering its almost constant association with *F. radiciola* in jelly-end rot, the author is inclimed to believe that it is one of the factors in causing this disease. When tubers infected with " black rot " are sown the crop obtained is to a large extent contaminated, while sowing tubers infected with " jelly-end " rot does not seem to entail harmful results.

*F. radicicola* is widely distributed in Europe and in America. In the United States it has ben reported from the following states : Idaho, Oregon, California, Nevada, Mississippi, New York, Virginia, and the district of Columbia. It is probably well distributed throughout the desert soils, where the damage caused to the potato crop by this parasite can attain to

*Percentage of Disease in Harvested Potatoes.*

| Variety | Condition of seed | Percentage of disease in tubers | |
|---|---|---|---|
| | | Vascular infection | Tuber-rots |
| Idaho Rural | Infected with blackrot | 96 | 82 |
| Pearl | do. | 44 | 40 |
| Netted Gem | Infected with jelly-end rot | 16 | 0 |
| Idaho Rural | Disease free, disinfected | 40 | 0 |
| Pearl | do. | 14 | 1 |
| Netted Gem | do. | 10 | 0 |

enormous proportions ; in fact anything up to 80 per cent of the tubers may be attacked. On the other hand, in a fertile and well irrigated soil, previously planted with grain or leguminous crops, the conditions are unfavourable to the forms of rot mentioned above, and the percentage of infected tubers is always very low.

Control of blackrot : 1) precede potatoes by a crop of lucerne or of other plants which can improve the soil ; 2) maintain the lowest possible temperature in all storage places.

1131 – ***Phytophthora* sp., as the Cause of Black Thread Disease of *Hevea brasiliensis* in Burma.** — DASTUR, I. F., in *Department of Agriculture, Burma, Bulletin* 14, pp. 1-4, 1 plate, Rangoon, 1916.

In *Hevea brasiliensis* black vertical grooves appear on those parts of the trunk that have been laid bare by tapping ; these sink into the wood through the cambium. The infected parts crack and the latex oozes out and some times accumulates between the wood and the new cortical tissue that is being formed. The latter withers and comes off leaving a deep wound or canker in the uncovered woody tissue.

In this way the cambium can be absolutely destroyed. The destruction and alterations in the cambium put a stop to the ordinary renewal of the cortex, but there is an abundant proliferation of callous tissue, and the surface of the trunk which has become gnarled and irregular is not suitable for new incisions. In sections of the diseased tissue the cells are swollen without protoplasmic content, and filled with a yellow-brown gummy substance.

The constant presence of intercellular, non septate hyphae at once suggests the existence of a species of *Phytophthora*, especially, when in addition to the disease of the trunk, a characteristic alteration is observed in the fruits, accompanied by an exudation of latex undoubtedly caused by a *Phytophthora*.

Cultures obtained from diseased fruits and inoculated into the stems of *Hevea* give rise to pathological symptoms identical with those described.

Drought and light are important factors in checking the development of the fungus, which requires moisture. The disease appears soon

after the rains break out and completely disappears after the close of the monsoon with the return of the dry and sunny weather.

The damage caused by " Black thread " is very serious; in 1915 in a plantation of 77 000 trees in Burma, tapping was prevented in 12 000, the loss of rubber being estimated at two to three thousand pounds.

Treatment : 1) the fungus fructifies very poorly on the stem but very profusely on the fruits which should be considered as the principal source of infection ; infected fruits should therefore be collected and destroyed when they first appear ; 2) pruning should be freely indulged in, so that penetration of sunlight and free circulation of air are ensured ; 3) tapping should be stopped and the tapping cuts treated with a 20 per cent solution of carbolineum every five days.

1132 – ***Corticium salmonicolor*** **(" pink disease ") of Cacao, in the Island of Trinidad, Antilles** (1). — Rorer, J. B., in *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XV, Part. 3, pp. 86-89, I pl., Port-d'Espagne, 1916.

At rare intervals during the past seven years the cacao disease known as " pink disease " has been recorded on several plantations in the northern and eastern parts of Trinidad. The disease receives its name from the fact that the attacked branches, especially on the lower or shaded side, are covered with a pink incrustation which is the fruiting stage of the fungus that causes the disease, *Corticium salmonicolor* Berk. and Br. (and not *C. lilacino-fuscum* Berk. and Curt. as was formerly believed).

Up to the present time the fungus is not a really serious menace to cacao cultivation in the West Indies.

It can live at the expense of great many plant hosts and so has caused considerable damage elsewhere ; for example, to *Hevea* in the United States, to coffee in Java, etc.

In the case of cacao the small branches are most often attacked and are rapidly killed ; if the fungus in the course of its rapid development reaches the larger branches the whole crown of the tree may become infected. The leaves on the diseased branches wither, turn brown and fall to the ground.

Where the disease occurs sporadically the infected branches should be cut out and burnt immediately. If the diseased parts have to be carried out of the plantations they should be put in bags to prevent the dispersal of the spores of the parasite. If the disease should assume serious proportions Bordeaux mixture or other fungicides could be usefully employed. This is a simple matter in cacao plantations or in rubber plantations where the plants are two or three years old.

In cases of serious attack in old rubber plantations spraying is not recommended on account of the almost insurmountable difficulties met with in treating large trees. The disease is more effectively dealt with by cutting out and burning the affected parts, where this is possible, or where only a limited number of trees are attacked. If the infection is wide spread good results have been obtained by treating the diseased parts with tar as soon as

(1) See also Bulletin Sept. 1913, No. 1107, and Bulletin Feb. 1915, No. 135. (*Ed.*).

the first symptoms appear. In Trinidad the disease has never so far been discovered on rubber, but now that this plant, is fairly widely cultivated there and in some cases among cacao trees, the surrounding cacao should be carefully watched, so that in case the fungus should appear precautions could be promptly taken to prevent its spreading to the rubber.

1133 – ***Phoma Lavandulae*** **on Lavender (*Lavandula officinalis*) in England.** — BRIERLY, W. B., in *Bulletin of Miscellaneous Information, Royal Botanic Gardens, Kew*, No. 5, p. 113-131, Figs. 1-9, Pl. V-VI, 1916.

*Phoma lavandulae* Gab. was recorded for the first time in England in 1915. It is the cause of a serious disease in *Lavandula officinalis*. The diseased buds and shoots are brown in colour, the leaves wither and fall, and the epidermis splits away in minute silvery flakes. The infection spreads very quickly from one plant to another so that it readily attacks and destroys whole beds.

In pure cultures the fungus produces pycnospores and conidia, which are hyaline with thin walls (which later on become brown while the walls thicken), and characteristic brown chlamidospores, with very thick walls. The thin walled spores germinate quickly ; they are not very resistant to drought and are killed by frost. The thick walled spores on the other hand are very resistant and only germinate after a resting period.

Inoculation experiments gave positive results, and confirmed the pathogenic properties of the fungus which is very probably confined to the genus *Lavandula*. The mycelium branches freely through the host tissues, causing disintegration of the peridermis and phloem. It also penetrates into the xylem and the hyphae often reach the inside of the cells through the pits in the walls. The pycnidia are formed immediately below the epidermis which splits away from the cortex. The optimum temperature for the growth of the mycelium is about 18° to 20° C.

To check the infection the diseased shoots should be cut out and estroyed as soon as they appear.

1134 – ***Fusarium*** **sp. ("die-back disease") a Pest on *Hibiscus* in the Federated Malay States.** — SHARPLES, A., in *The Agricultural Bulletin of the Federated Malay States*, Vol. VI, No. 7, pp. 217-218, Singapore, 1916.

Several species of *Hibiscus* which are cultivated in the Federated Malay States for ornamental purposes are attacked by a fungus that kills the shoots. The disease, whose common name is " die-back disease ", develops principally in hedges of *H. Rosa-sinensis* which are periodically pruned. The shoots blacken and die from the top onwards, the leaves wither and fall, and finally the plant is reduced to a cluster of dead branches. The author has been able to isolate from infected material two fungi in pure cultures (*Colletotrichum* sp. and *Fusarium* sp.). Inoculation experiments showed that *Fusarium* sp. is the specific cause of the disease described above. The mycelium of the parasite penetrates the host by means of the numerous lesions and cuts which result from pruning. It is therefore suggested that this operation should always be followed by an immediate dressing with Bordeaux mixture.

## WEEDS AND PARASITIC FLOWERING PLANTS.

1135 – ***Razoumofskya* spp. Mistletoes Injurious to Conifers in the United States** — WEIR, J. R., in *United States Department of Agriculture, Bulletin* No. 360, pp. 1-39, Fig. 1-17. Washington, D. C., 1916.

It is not generally known that the injury caused by several species of *Razoumofskya* (*Arceuthobium*) to coniferous trees in certain localities of the north western United States has attained to such proportions that the question has assumed all the characters of a serious forest problem. The species which suffer the most are : Western Larch (*Larix occidentalis*), Western Yellow Pine (*Pinus ponderosa*), Lodgepole pine (*P. contorta*), and Douglas Fir (*Pseudotsuga taxifolia*). Each of these hosts in attacked by a distinct species of *Razoumofskya*: *R. laricis* Piper; *R. campylopoda* (Engelm.) Piper; *R. americana* (Nutt.) Kuntze ; *R. Douglasii* (Engelm.) Kuntze.

The most striking symptom of the disease is the gradual reduction of the leaf surface, caused by the " witch's brooms " and by various outgrowths which occur on the trunk and branches, and which in time can cause the death of the host. In all the cases the development of the tree is seriously retarded, as is shown in the following table :

| Host and condition | Basis (number of trees) | Average | | | |
|---|---|---|---|---|---|
| | | Age class | Height | Diameter breast high | Total annual growth |
| | | years | feet | in. | in. |
| *Pinus contorta* | | | | | |
| Infected | 50 | 65 | 35.2 | 6.3 | 0.93 |
| Uninfected | 50 | 60 | 48.5 | 7.8 | 2.93 |
| *P. ponderosa* | | | | | |
| Infected | 50 | 100 | 49.5 | 18.2 | 1.54 |
| Uninfected | 50 | 100 | 77.2 | 22.2 | 5.33 |
| *Larix occidentalis* | | | | | |
| Infected | 80 | 144 | 63.0 | 11.5 | 1.28 |
| Uninfected | 80 | 144 | 115.0 | 19.5 | 2.154 |
| *Pseudotsuga taxifolia* | | | | | |
| Infected | 40 | 97 | 62.0 | 17.3 | 2.175 |
| Uninfected | 40 | 97 | 73.0 | 22.2 | 3.28 |

One of the first effects of infection, either of branch or of trunk, is the formation of a fusiform swelling, which is sometimes very pronounced and resembles the enlargements caused by some species of *Peridermium*. On the branches this swelling is the first stage in the development of a

" witch's broom " which grows slowly and attains to enormous proportions. The habit and appearance of the tree is entirely altered. Often under the stress of snow and wind the " brooms " split and fall to the ground, where, piled round the foot of the tree, they constitute a serious danger in case of ground fires.

On the trunk the presence of *Razoumofskya* leads to the formation of burls. When the infection occurs at the base of a branch and then travels towards the main trunk the result is a " broom " which later dries up and falls, leaving in its place a burl which is more or less scarred. If, on the contrary, infection occurs directly on the main trunk, the beginning of a burl is at once formed, and this radiates outwards and becomes fan-shaped keeping time with the growth of the tree. Finally the central part of the swelling disintegrates leaving a wide opening more or less deep. This is a convenient entrance for boring insects and for numbers of fungi, which find the decomposing tissues an excellent substratum : *Trametes Pini* (Brot.) Fr., *T. serialis* Fr., *P. volvatus* PR., *Fomes Laricis* (Jacq.) Murr., *F. pinicola* Fr., *Stereum sulcatum* Burt., *Polyporus sulphureus* Fr., *Lenzites sepiaria* Fr., *Corticium Berkeleyi* Cooke, *C. galactinum* (FR.) Burt., *Peniophora subsulphurea* (Karst) Burt, *Ceratostomella pilifera* (Fr.) Wint., and, less often, *Pholiota adiposa* DFr., and *Echinodotium tinctorium*.

The following means of suppressing *Razoumofskya* are suggested ;

1) to fell and remove all badly infected trees, which may or may not be a useful measure ;

2) strict control of nurseries and supervision of plants coming from infected areas ;

3) to plant conifers closely, and eventually to associate them with other species such as yews and junipers which will shut out the light, as shade discourages the development of mistletoe.

1136 – ***Asphodelus fistulosus* and *Stachys arvensis*, Harmful Weeds in New South Wales.** — MAIDEN, J. H., in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, Part. 5, pp. 335-338, 2 Pl., Sydney, 1916.

A description of *Asphodelus fistulosus* L. (" onion weed ") and of the labiate *Stachys arvensis* (" stagger weed ").

In Australia the first of these weeds is known not only in New South Wales but also in central Australia (where it is common), in Victoria and in western Australia ; it has not yet been recorded from Queensland. It tends to overrun the ground wherever it manages to establish itself, and no animal appears to feed on it except by accident. Burning it before the flowering season, if possible entirely, is the best method of suppressing this weed.

*S. arvensis* is common in central Australia, in New South Wales, in Queensland and in Victoria ; in New South Wales it is especially frequent, and is reported as causing serious trouble among cattle. As it thrives best in damp places it is advisable to improve the drainage of pasture lands to encourage the development of useful plants.

(1) See also *B.* Dec. 1913, No. 1403, and *B.* Feb. 1914, No. 187. (*Ed.*).

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

GENERALITIES.

1137 – **Insect Pests in India.** — FLETCHER, T. B., in *Agricultural Research Institute, Pusa, Bulletin* No. 59, pp. 1-39, Fig. 1-20, Calcutta, 1916.

The work in question contains one hundred short notices on Indian insect pests.

The following observations, dealing for the most part with agriculture, are worthy of special notice.

Among the Coleoptera, *Adoretus lasiopygus* (fam. *Rutelidae*) is a very common species in the Pusa district, where it causes considerable damage to the leaves of plants between June and September; at Begum Serai it attacked vines stripping off the leaves and injuring the fresh shoots.

*A. versutus* is also very common in numerous Indian localities; it was reported in June 1910 and 1912 from the Kumaon gardens as a pest on the leaves of vines, pears, plums, apples, and figs, which it attacked in association with *A. horticola* Arrow and *Brahmina coriacea* Hope. Similar damage is caused by another species of *Adoretus* (*A. duvauceli* Bl.).

Numerous Coleoptera belonging to the family *Curculionidae* inflict more or less extensive injuries upon cultivated plants. There are *Phytoscaphus dissimilis* and *Corigetus bidentulus* on tea in Assam and Upper Burma; *Rhynchaenus* (*Orchestes*) *magniferae* (mango leaf boring weevil), *Cryptorhyncus poricollis* and *Alcides frenatus* on mango trees; *Xanthotrachelus faunus* and *X. perlatus* which attack the heads of *Helianthus annuus*; *Calandra linearis* on the fruits of tamarinds and *Myocalandra exarata* on bamboos.

In July 1915 *Lytta actaeon* (Family *Meloidae*) attacked the fields of *Setaria* in the region of the Chota Gandak River in great numbers, completely devouring the leaves.

Among the Lepidoptera, *Calpe ophideroides* caused great damage to fruit in 1914 in the Kumaon Government, especially to peaches and nectarines.

The larval stage of *Argyroploce erotias* (Family *Eucosmidae*) caused considerable damage to the foliage of mangoes by rolling up the leaves and biting holes in them.

*Laspeyresia trichocrossa*, which belongs to the same family, in its larval stage bores its way into the pods of *Cajanus indicus* and there pupates, having destroyed the seeds.

In March 1912 at Pusa the larvae of *Anarsia melanoplecta* were seen to hollow out tunnels in the top shoots of mango twigs.

*Anataractis plumigera* formed galls on the stems of *Indigofera* in which the larvae underwent their first developmental stages.

The larvae of *Acrocerops syngramma*, *A. cathedra* and *A. isonoma* attacked the leaves of mangoes (mango leaf-miners). The caterpillar of *A. ordinatella* feeds in the parenchyma of the leaves of camphor leaving the epidermis intact.

*Prays citri* (Family *Hyponomeutidae*) is found in southern Europe,

in New South Wales (Australia), in the Philippines, in India (North Coorg,) and in Ceylon (Colombo, Maskeliya and Mandulsima). In southern Europe the larvae eat into the flowers and the shoots. In the Phillippines they bore into the rinds of Citrus fruits making a gall, so that the fruits may be seriously damaged. It is quite possible that this insect will soon become a pest in India and Ceylon, where at present its interest is purely entomological.

1138 – **The Caterpillars of the Goat Moth (*Cossus cossus*) and the Codling Moth (*Carpocapsa pomonella*) and their Powers of Resistance to Cold.** — GUEYLARD, F. P., in *Comptes Rendus des Séances de la Société de Biologie*, Vol. LXXIX, No. 15, pp. 774-777, Paris, July 29, 1916.

Experiments show that the caterpillar of *Cossus cossus* can resist freezing of all its organs and tissues. The caterpillar does not appear to suffer even if it is frozen any number of times. A quick transition from a temperature of -15° C. to one of 30° C. does not cause death and does not apparently change the tissues. This resistance results from an adaptation which only occurs in nature during the cold season. It disappears completely during the hot heather.

The caterpillar of *Carpocapsa pomonella* apparently reacts to cold in exactly the same way as that of *Cossus*. This remarkable resistance to cold does not seem to be very wide spread among the invertebrates. It is even far from occuring in the xylophagus larvae.

These differences seem to be correlated with certain peculiarities in the mode of life of these larvae.

MEANS OF PREVENTION AND CONTROL

1139 – **Observations on the Insect Parasites of Some Coccidae.** — IMMS, A. D., in *The Quarterly Journal of Microscopical Science*, Vol. 61, Part. 3, pp. 217-274, 5 Figs. 2 Pl. London, 1916.

This is the first of a series of papers dealing with the biology of the principal insect parasites of certain *Coccidae*, with a view to determine the importance of these parasites in their relation to a family whose economic importance is very considerable. That certain of the *Coccidae* are extensively parasitised is well known, but up to the present time, little has been known of the effects of this parasitism. At the same time these cannot be understood until the essential characters of the relation between host and parasite are fully known. The present paper treats of *Aphelinus mytilaspidis* Le Baron, one of the chief parasites of the " mussel ,, scale (*Lepidosaphes ulmi* L.).

The paper contains a very complete bibliography, and clear illustrations.

*L. ulmi* is the commonest of the injurious *Coccidae* found in the British Isles. Its favourite food-plant is the apple, but QUAINTANCE and SASSCER record over 118 host plants. It has been stated that the females begin to lay their eggs on or about August 17, and that they continue oviposition on into September. By the end of October almost all the parents are dead and their scales protect the eggs. The newly hatched larvae appeared on May 21 in the following year, and the developmental cycle is completed by

the end of July or the beginning of August. In Great Britain the insect is single brooded, but in certain regions of North America there are two broods.

The number of eggs laid varies a good deal. In America apparently the average number does not exceed 80, while in England the average is about 37,2 eggs per female.

The genus *Aphelinus* is placed among the parasitic Hymenoptera and belongs to the sub-family *Aphelininae*. This sub-family is very widely distributed, species being known from almost all parts of the globe, with the exception of the colder temperate and polar regions. A list of the localities in England in which it occurs is given in this paper.

The larvae of the *Aphelinae* are either exclusively parasitic or parasitic and partially predaceous. They confine their attacks almost exclusively to the *Rhynchota*, the *Coccidae* and the *Aphididae* being their principal hosts.

Several hosts are mentioned as being subject to the attacks of this parasite in various regions. The author gives detailed descriptions of diverse stages in the two sexes, of parthenogenesis, of oogenesis, and of the external and internal morphology. Experiments in breeding have been successfully carried out in the Manchester University Biological Experiment Ground, in specially constructed breeding cages, with a view to investigating the biology of the parasite.

The life history of the parasite can be summarised as follows : in one year it passes through two generations, and the adults are almost, always females. Out of 750 individuals reared only 10 were males, about 1 per cent. Reproduction takes place almost entirely by means of parthenogenesis. The adults very rarely fly, and have extremely limited powers of migration. In the first generation the adults appear in greatest frequency between the third week in June and the middle of July. The female lays a single egg on the dorsal or ventral surface of the body of the immature host, only the scaly covering of the latter being perforated. The newly hatched larva closely resembles the fully grown stage in form, and during larval life the insect is an ectoparasite of its host. The second generation of adults mostly appear between the middle of August and the first week in September. They parasitise the sexually mature hosts, and the resulting larvae hibernate through the winter, giving rise to the first generation of adults of the following year. The results of the first generation of parasitism are complete, the affected hosts invariably dying in consequence. In the second generation of parasitsm the affected hosts usually deposit a small number of eggs before succumbing ; its results, therefore, are partial and incomplete. The parasite exercises an inhibitory effect upon oviposition, the essential reduction in the number of eggs not being primarily due, as stated by previous observers, to their destruction by the *Aphelinus* larvae. Assuming that every 100 hosts lay on an average 37 200 eggs, the net results of a year's parasitism entails a reduction of about 2600 in the number of eggs laid, or 7 per cent. The efficiency of the parasite, therefore, is far below that of the most effective insecticides. This is primarily due to four factors : 1) its

extremely limited powers of migration ; 2) its relatively low fecundity ; 3) its marked susceptibility to the influence of unfavourable climatic conditions ; 4) the effects of the second annual generation of parasitism being only partial and incomplete.

1140 – ***Aphicus hesperidum*** **n. sp., an Ectophagous Parasite on the Cochineal of Citrus Fruits *Chrysomphalus dictyospermi* in Spain** (1).— MERCET, R. G., in *Revista de la Real Academia de Ciencias exactas, físicas, y naturales de Madrid*, Vol. XIV, No. 11, pp. 776-788, Fig. 1-5 Madrid, 1916.

A description of the new Chalcidid *Aphycus hesperidum*, an ectophagous parasite of the cochineal insect discovered by the writer on orange trees (at Seville, Huelva, Valencia and Palma in Mallorca), on laurels (at Palma in Mallorca) and on oleanders (at Seville) which had been attacked by this cochineal.

The female of this Chalcidid lays her eggs under the silpha of the host, which later on is devoured by the larva after it has been hatched.

Among the natural enemies of *Chrys. dictyospermi* (2), the writer particularly mentions *Aphelinus chrysomphali*, which he has described in an earlier paper, *Prospaltella lounsburyi* and *Chilocorus bipustulatus*.

1141 – ***Hyperaspis binotata*****, a Coccinellid Beetle Predatory on *Eulecanium nigrofasciatum*** **(terrapin scale)** — SIMANTON, F. L., in the *Journal of Agricultural Research*, Vol. V, No. 5, pp. 197-203, 1 Fig., Pl. XXIV-XXV. Washington, D. C. 1916.

During a good season the adults of *Hyperaspis binotata* Say destroy great quantities of *Eulecanium nigrofasciatum* Pergande. They hibernate on the bark and in the vegetable refuse at the foot of peach trees infested by terrapin scale. They emerge towards the end of April (at Mount Alto, Pa.) Mating takes place in the spring and oviposition continues until the beginning of September.

The larvae not only devour the young of the scale but also the adults. It is estimated that a single larva of *Hyperaspis* is able to destroy 90 mature scales and 3000 larvae of *Eulecanium*.

*H. binotata* is common in the whole of the territory east of the Mississippi, and extends west of this river in some states to the semi-desert region. It is most abundant on the Atlantic side, from Connecticut to Maryland.

1142 – ***Holcocera iceryaeella*****, a Lepidopteran that Destroys Cochineal Insects in California.** — ESSIG, E. O., in *Journal of Economic Entomology*, Vol. 9, No. 3, pp. 369-370, Pl. 28. Concord, 1916.

During the summer of 1915 the author undertook a series of researches and observations on *Holcocera iceryaeella* (Riley) (*Blastobasis iceryaeella* Riley), a Lepidopteran which destroys cochineal insects, and which occurs in great numbers on the experimental farm of the University of California. It is not easy to establish exactly the way in which this insect is nourished

(1) See *B.* February 1913, p. 170 ; and *B.* June 1913, No. 765.

(2) See *B.* April 1915, No. 451 ; *B.* Oct. 1915, No. 1102 ; *B.* July 1916, No. 827 ; *B.* August 1916, No. 948. (*Ed.*).

and in what proportion the dead and living cochineal insects occur in its food.

Among its hosts, in addition to *Saissetia oleae* Bern (black scale) and *Icerya purchasi* Mask. (Cottony cushion scale or fluted scale) which are already known, the author cites *Lecanium persicae* Fab. (European peach scale), *Aspidiotus camelliae* Sign. (greedy scale) and *Pseudococcus bakeri* Essig (Baker's mealy bug).

The *Holcocera* larvae weave large nets on the branches of the plants, and without leaving these, they feed upon the eggs and the young individuals of the cochineal insects which pass the entrances, but the adults are never attacked.

1143 – **Birds in the Vineyards in the Region of Nîmes.** — HUGUES, A, in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. II, No. 17, pp. 504-508. Paris 1916.

The birds which live in vineyards in the region of Nîmes are passed in review ; these birds feed upon insects and do not attack the grapes, they thus are worthy of efficient protection. The author cites in particular the ortolan (*Emberiza hortulana*), the stonechat (*Pratincola rubicola*), the wheatear (*Saxicola oenanthe*), the European bunting (*Miliaria europaea*), the crested lark (*Galerida cristata*), the short toed lark (*Alauda brachydactyla*), the common linnet (*Cannabina linota*), and the warblers. The tomtit (*Parus major*) is recorded as being especially efficient; it attacks the woolly bear caterpillars of the tiger moth (*Arctia* or *Chelonia caja* L.) and those of *Cuculus canorus*. The European night-jar (*Caprimulgus europeaus*) destroys butterflies.

Red partridges (*Perdrix rubra*) and magpies (*Pica caudata*) eat the grapes but most often the damage is done to the bordering plants. In this district in a good year about 659 625 gallons of wine are gathered in, and the losses caused by these two birds do not exceed 27 000 gallons. Fieldfares arrive in October and eat the grapes left by the grape gatherers and the gleaners, grapes which are in any case lost to the vine-grower. The golden oriole (*Oriolus galbula*) and the sparrow (*Passer domesticus*) have not caused any complaints. In conclusion, in the vineyards of lower Provence there is not a single bird that is really harmful, while there are a great many that are of use.

INSECTS INJURIOUS TO VARIOUS CROPS

1144 – **The Thermites (*Leucotermes* spp.) Harmful to Agriculture in the United States.** — SNYDER, T. E., in *United States Department of Agriculture, Bulletin* No. 333, pp. 1-32, Fig. 1-5, Pl. I-XV. Washington, D. C. 1916.

The three best-known species of termites (white ants) in the United States are : *Leucotermes flavipes* Kollar, distributed over the whole of North America, from the Pacific to the Atlantic, and from Canada to the Gulf of Mexico ; *L. lucifugus* Rossi, common in Texas, Arizona, Kansas, Colorado and South California, and *L. virginicus* Banks, indigenous to Maryland and Virginia (including the district of Colombia). They cause considerable damage to the principal plants cultivated, apart from wood and other materials (e. g. paper, books).

These insects attack the stem of the cotton plant at a depth of about

3 inches below the soil and penetrate into it boring tunnels of varying dimensions ; they cut into and gnaw all the tissues to such an extent that the aerial parts of the plant often wither and die. In June and July 1910 observations were made at Lampasas, Granbury, Pearsall, Plano in Texas.

Termites also make furrows and bore holes in the surface of potato tubers, but, according to MARLATT, they confine their attacks to potatoes infected with " gale ".

Considerable damage to maize has often been recorded in North Carolina, Kansas, Tennessee and Alabama. The termite workers penetrate into the stem and only leave a thin superficial layer intact. In their work of destruction the termites generally make use of galleries bored by other insects (*Diatraea saccharalis* Fab. and *Sphenophorus maidis* Chittn.) ; they confine themselves to enlarging and completing these galleries, which fact does not however exclude the possibility of an attack being directed against perfectly healthy plants. In August 1908, in the plantations of Chemson College (South Carolina), 5 per cent of the stems were infested and each stem contained from 5 to 75 termites.

In the Kansas nurseries in 1909 and 1910, the termites, encouraged by the dry season, attacked the young saplings of apple trees, from 1 to 3 years old, gnawed the bark and caused the death of a great number of the trees.

In several localities in the United States, geraniums, rosetrees, jessamine, laurestinus, *Opuntia* and many other ornamental plants in hot houses and the open air alike, often suffered from the attacks of termites.

Methods of combating these pests : 1) collect and destroy the prunings of branches and all the vegetable debris in which these animals often find suitable shelter ; 2) in badly infected regions avoid the cultivation of the plants which are most liable to attack for several years and give preference to grasses ; 3) during the operation of ploughing, digging, etc., avoid burying vegetable debris in which termites can hide ; 4) in hot houses and nurseries dispense with animal manures and give the preference to chemical manures ; 5) if the plant in question is a vine proceed carefully with pruning avoiding serious lesions, and finally cover the scars with coal tar or other substances of a similar nature.

1145 – ***Pulvinaria floccifera* and *Chrysomphalus dictyospermi*, Cochineal Insects Recently Established in California.** — ESSIG, O. in *The Monthly Bulletin of State Commission of Horticulture*, Vol. V, No. 5, pp. 192-197, Fig. 65-70. Sacramento Cal., 1916.

Among the insects imported into California from other countries a certain number of cochineal insects figure, some of which cause great damage to kitchen-gardens and orchards.

*Pulvinaria floccifera* Westwood (Camellia scale) and *Chrysomphalus dictyospermi* Morgan (Dictyospermum scale) are of very recent importation.

Up to the present *P. floccifera* has only been able to establish itself in a single locality in San Jose. Here we are dealing with a cosmopolitan parasite common throughout the temperate zone, and well known in the

eastern and southern regions of Canada and of the United States. Its favourite host as its English name indicates is beyond doubt the *Camellia japonica*; then come *Euonymus* sp., *Oncidium Papilio*, *Calanthe natalensis Anguloa Clowesii*, *Lycaste Skynneri*, *Acalypha* sp., *Brassica verrucosa*, *Phaius maculatus*, *Coffea arabica*, and *Euonymus alatus*.

*Chrys. dictyospermi*, widely distributed over the tropical and sub-tropical regions, is also met with in the temperate zone, in hot houses and sheltered places. In California this species has been recorded from Ventura, Berkely, Marysville, and San Diego. It is mentioned as attacking *Kentia*, orchids in general, *Coelogyne cristata* and *Persea gratissima*. In other regions this cochineal insect has also been observed on *Dictyospermum album*, *Erythrina indica*, *Cycas* sp. (sago palm), *Latania* sp., on palms in general, on *Mangifera*, *Pandanus graminifolius*, *Areca triandra*, *Cypripedium* sp., *Dendrobium* sp., *Anthurium* sp., *Aloe Zeyheri*, tea plants, *Ficus* sp. etc.

In the Italian peninsula, in Sicily and in Spain, this insect causes serious damage to citrus plants, hence the necessity of careful supervision, so that the parasite may not extend its attacks to this group in California.

1146 – ***Chortophila cilicrura* and *Thereva* sp., Pests on Rye in Silesia, Germany.** — OBERSTEIN, in *Zeitschrift für Pflanzenkrankheiten*, Vol. 26, Fasc. 5, pp. 277-280. Stuttgart July 30, 1916.

In Silesia, during the period of vegetation of 1914 and 1915, it was observed that the winter crops were attacked by a pest which devoured the leaves from the top to the bottom in succession, almost to the foot of the plant. This damage was recorded from a vast extent of land, and although the same caused great damage in these localities, it was certain that it had not done the mischief in question. The parasite also attacked the corn, but it did more harm to the rye.

On November 22, 1915 the Experimental Station for Agricultural Botany of the Chamber of Agriculture of Silesia, received from the district of Glogau, larvae and pupae which came from three fields of rye. According to the peasants the larvae, by eating the grain immediately before and after germination, had caused great damage to the young plants which by degrees died.

After rye, lupins were grown and were also attacked. On December 11, 1915 the Station received a second consignment of pupae—there were no more larvae—which were used to identify the insect; at the beginning of February 1916 laboratory breeding experiments gave rise to males and females of a Dipteran which was identified as *Chortophila cilicrura*.

On October 17, 1915 another pest, hitherto unknown, was sent from the district of Steinau a. O. to the Station. The infected rye succeeding sarradilla had hardly germinated. The young plants were gnawed; a great number of white diptrous larvae were found in the soil which were without legs, shaped like wire-worms and with little black heads. A neighbouring rye field in which the previous crop had been oats was unattacked; the rye had germinated satisfactorily. All the rye examined was treated with

" Uspulun " before the harvest (1). About a month later only a few larvae of different sizes were found. The insect was identified as *Thereva*, but the species is not yet known. As the pest has appeared in great number in other places as well, the writer decided to study it in detail.

1147 – **The Potato Ladybird Beetle (*Epilachna dregei*), a Coleopteran Pest on Potatoes and other Plants in South Africa.** — GUNN, D. in *Union of South Africa, Department of Agriculture, Division of Entomology*, No. 6, pp. 1-7, 1 Pl. Pretoria, 1916.

This insect, which is now spread over the whole of South Africa, attacks countless cultivated and wild plants, being especially injurious to the potato.

On an average, in both the first and the second generations, the life cycle of *Epilachna dregei* occupies 49 days; in the first generation its minimum length is 41 days, and in both the maximum is 57 days. The duration of each period is as follows:

| | |
|---|---|
| Incubation | 7 to 11 days |
| Larval existence | 28 to 36 days |
| Pupal existence | 6 to 10 days |

The eggs are laid in little heaps on the under surface of the leaves of the host; when hatched the larvae remain in groups until the first change of skin, after which they spread over the whole plant, eating the foliage. The adults finish this work of destruction, for they leave nothing but the veining intact, so that the plant soon withers and dies. During the summer of 1913, about 18 acres of potatoes were destroyed on a single estate near Johannesburg.

Applications of lead arseniate (about 3 lbs. in 48 gallons of water) are suggested as soon as the larvae appear as a means of prevention.

Besides potatoes, this *Epilachna* also attacks pumpkins, cucumbers, spinach, turnips, radishes, melons, beans and some of the *Solanums* which grow in the gardens and fields.

1148 – **The Clover Leafhopper (*Agallia sanguinolenta*), an Hemipteran Pest on Leguminous Forage Plants in the United States.** — GIBSON, E. H., in *United States Department of Agriculture, Farmer's Bulletin*, No. 737, pp. 7-8, Fig. 1-5, Washington. D. C., 1916.

*Agallia sanguinolenta* damages the Leguminous plants used for forage, more especially lucerne and clover, in various ways. Numerous specimens (sometimes as many as 600) collect on a single plant, they pierce the epidermis of the leaf stalk and extract some of the juice from the tissues, so that the most delicate branches wither, and the new shoots which are poorly nourished develop badly. In addition, the females, by laying their eggs at a considerable depth in the peridermis and parenchyma, provoke the formation of galls which check the normal development of the plant.

Preventive measures: 1) during the winter burn the vegetable debris

(1) See *B.* August 1916, No. 938. (*Ed.*).

and weeds in the fields, along the roads and in the uncultivated steppes where the insects hibernate ; 2) if the attack is very violent cut the forage earlier to deprive the voracious insect of its favourite food ; 3) catch the insect by means of an ordinary hopperdozer.

1149 – **The Pepper Tree Caterpillar (*Bombycomorpha pallida*), a Lepidopteran Pest on the Pseudo-Pepper Tree (*Schinus Molle*) in the Transvaal.** — DUNN, D. in *Union of South Africa, Department of Agriculture, Division of Entomology*, No. 4, pp. 1-10, 1 Pl. Pretoria, 1916.

During the last few summers considerable damage was caused to *Schinus Molle* in Pretoria and the surrounding country by the larvae of *Bombycomorpha pallida* Dist., which feed upon the leaves of this tree. The eggs which are stuck together by a gelatinous substance form a coating round the branches of the plant host 2 or 3 cms. long. The larvae which are all hatched out at the same time have a markedly gregarious tendency, and, having devoured the leaves on which they were born, they prefer to destroy each other, instead of separating and emigrating. Thus cannibalism occurs and brings about the destruction of the smallest and feeblest specimens. Finally, having exhausted all the possible resources, the larvae emigrate in groups of five or six to other parts of the tree and finish stripping off its leaves.

As a means of artificial resistance the following may be used : 1) gathering the branches on which the larvae occur when all of them may easily be destroyed ; 2) applications of lead arseniate (about 3 lbs in 48 gallons of water) ; 3) when the larvae are mature they abandon their host and crawl down to the ground, looking for a suitable place in which to pupate : if pieces of cloth, or other material, are placed round the stem the larvae can easily be caught as they emigrate in great numbers. Thus future infection can be checked.

1150 – ***Pegomyia hyoscyami*, a new Dipteran in the United States, Harmful to Spinach and other Plants** (1). — COREY, E. N. in *Journal of Economic Entomology*, Vol. 9, pp. 372-375, Fig. 21. Concord, N. H., 1916.

The appearance of an insect which is new to the United States has just been recorded. It is *Pegomyia hyosciami* Panz. whose larvae bore holes and galleries in the thickness of the leaves of *Spinacia oleracea*, *Chenopodium album* and *Amaranthus retroflexus*.

The female lays her eggs in a regular row on the under surface of the leaves ; the incubation lasts about four days ; the larvae feed on the leaf tissue and leave only the veining intact. The larval period lasts from 15 to 17 days, the pupal state only from 14 to 20 days.

The only known parasite is *Opius foveolatus* Ashm. A 5,6 or 7 per cent solution of barium chloride has been successfully used as a means of destroying the pest.

(1) See also *B.* March 1912, No. 585, and *B* Feb. 1913, No. 196 (*Ed.*).

1151 – ***Dacus vertebratus*** **(cucumber and vegetable marrow fly), a Dipteran which is Harmful to Cucurbitous Plants in South Africa.** — GUNN, D. in *Union of South Africa, Department of Agriculture, Division of Entomology*, No. 9, pp. 2-6, Pretoria, 1916.

*Dacus vertebratus* causes considerable damage to the cucumbers, pumpkins, water melons and in general to all the Cucurbitous plants that are cultivated in South Africa. The female lays her eggs, 10 to 25 at the same time, in the rind of the fruit : the incubation period is from 2 to 4 days. The larvae bore long galleries in the rind, which grows soft and shrivels up, they also bore in the pulp which becomes a semi-liquid mass with a rancid smell. The larvae when they are mature crawl into the ground where they pupate. The adults come out after 5 or 7 days and live from 1 to 5 months.

It is advisable as a means of control to spread over the plants in need of protection sweet substances (sugar etc.) of which the insect is very fond, mixed with poison. The following formulae have been successfully employed :

| | | |
|---|---|---|
| 1) Lead arseniate (in a paste) | 3 | oz. |
| Molasses | 2 | lbs. |
| Water | 2 | gallons |
| 2) Lead arseniate (in a paste) | 3 | oz. |
| Molasses | 2 | lbs. |
| Glycerine | 3 | oz. |
| Water | 2 | gallons. |
| 3) Lead arseniate (in a paste) | 2 | oz. |
| Sugar | 2 ½ | lbs. |
| Water | 2 | gallons. |

When the weather is warm and dry the applications must be made every 12 to 14 days. But if the weather is wet they should be renewed as often as possible immediately after the rain.

1152 – **Coleoptera Harmful to Fruit and to Flowering Plants Cultivated in South Africa.** — GUNN, D. in *Union of South Africa Department of Agriculture, Division of Entomology*, No. 8, pp. 1-6, 1 pl. Pretoria, 1916.

In South Africa in the summer several *Coleoptera* cause serious damage to the fruit trees and flowers in the orchards and gardens. Their favourite host is the peach tree, whose harvest they spoil to the extent of about 20 to 50 per cent, by attacking the ripe and the ripening fruit. Among other hosts are rose trees, dahlias, pears, plums, nectarines, apricots, figs, oranges (buds) and vines (leaves).

The species most often observed in the neighbourhood of Pretoria during the period 1913 to 1914 were the following : *Rhabdotis antica, Pachnoda, impressa, P. cincta, P. carmelita, Heterorrhina flavomaculata, Plaesiorhina recurva* var. *plana, Oxythyrea marginata* and *O. dysenterica.*

As a method of control the direct capture of the adults is advised ; this is effected by means of special butterfly nets fastened to the ends of long canes which can be used easily even by the natives.

1153 – ***Philagathes laetus* a Coleopteran Pest on the Peach Tree in South Africa.** — GUNN, D. in *Union of South Africa, Department of Agriculture, Division of Entomology*, No. 8, pp. 7-8, 1 Fig. Pretoria, 1916.

*Philagathes laetus* is for the first time recorded as harmful to peach trees in South Africa.

The adult attacks the ripe or ripening fruits causing lesions of varying extent. It may easily be caught by means of a butterfly net.

1154 – **The Plum Slug Caterpillar (*Parasa latistriga*), a Lepidopteran Pest on various Trees in South Africa.** — GUNN, D. in *Union of South Africa, Department of Agriculture Division of Entomology*, No. 7, pp. 1-7, 1 Pl Pretoria, 1916.

This insect, which is widely distributed throughout South Africa, attacks apple trees, peachs, plums, nectarines, and oaks in the neighbourhood of Pretoria, and it is certain that further work will increase the list of its plant hosts.

The whole life-cycle of *Parasa latistriga* is completed in 93 days in the case of the first generation, and in 270 days in the case of the second. The eggs are laid in groups on the under surface of the leaves. The larvae which hatch out of them feed on the leaves and leave nothing but the veining ; they then separate and emigrate to all parts of the plant.

Among the parasites of this insect are some of the *Hymenoptera* belonging to the family *Chrysididae*, whose action is very restricted. Effective preventive measures to be adopted against these larvae are applications of lead arseniate in a paste or copper arsenio-acetate mixed with lime.

1155 – **Concerning the Fruit Fly (*Ceratitis capitata*), in Tunis** (1). — GUILLOCHON, L. in *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. II, No. 16, pp. 473-477. Paris, 1916.

The writer gives an account of observations which he made in the Tunis Experimental Garden on *Ceratitis capitata* (the Mediterranean fruit fly of the Americans). The first mention of this fly dates back to 1898 ; the account given shows that the damage occasioned by the insect was confined to slow ripening peaches, which points to the conclusion that *Ceratitis* in the pupal state only develops after hibernation, at an average temperature of 20 C° higher than that required for the ripening of early varieties of American peaches.

The immunity is not however entirely a question of varieties, as a matter of fact the early varieties that ripened late owing to transplantation were attacked like the late varieties.

The amount of damage done increased, and in July and August the writer recorded the presence of larvae on peaches, apricots, kakis and aberias; in August, September and October on pears and apples, and finally in December and January on oranges more especially on mandarins.

Henneguy's plan of sticking a certain number of fruits on to each tree with honey to act as traps, was followed without success, as was Trabut's of making traps with a solution of colophony in alcohol with the addition of castor oil. The writer then decided to have the fallen fruit picked up every

(1) See also *B.* May 1916, No. 604.

day and even to shake the trees in order to bring down the infected fruit and to burn it all.

In 1910 a few specimens of *Ceratitis* were reared in entomological boxes and it was observed that the mature larvae free themselves from the opening of the fruit and bury themselves (August 19). Ten days later (August 29) five perfect insects 2 males and 3 females were winged ; the next day (August 30) there were 2 new females. An almost ripe peach which was placed in the box caused great agitation : the flies went backwards and forwards, on August 31 the females crawled over the fruit, by the first of September 2 of them were dead, and 3 others on the second. Experiments made by rearing them on pears and apples gave the same results, with a rather longer incubation period (21 days instead of 10).

On the growing fruit the larvae collect in the part of the mesocarp next to the stone, and in fruits like oranges in the spaces next to the seeds. In autumn when the temperature falls, *Ceratitis* pupates, and passes the winter in the pupa at the foot of the tree a little way below the surface of the ground.

The insect is dangerous in so far as it adapts itself readily to different climates ; it is recorded from the West Indies, which should be its original home, in the Islands of Hawai, in Oceania, in the regions around the Mediterranean, and in certain comparatively hot summers, in the neighbourhood of Paris (1). It lives at the expense of fruits which are far removed from one another and which ripen at very different times.

Back and Pemberton of the United States Department of Agriculture record as parasites of the *Ceratitis* introduced by Silvestri : *Galesus silvestrii, Dirhinus giffardii, Opius humilis ; Syntomosphyrum indicum* has also been recorded (2).

## INJURIOUS VERTEBRATES.

1156 - **Cottontail Rabbits (*Sylvilagus* spp.) in the United States.** — Lantz, D. E. in *United States Department of Agriculture. Farmer's Bulletin* No. 702, pp. 1-12, Fig. 1-5. Washington, D. C., 1916.

Over a great part of the United States cottontail rabbits (Gen. *Sylvilagus*) cause more or less extensive damage in cultivated land, especially during the winter, when their ordinary pastures are covered with snow and they are driven to attacking trees (especially apples) by gnawing them and tearing off the bark ; in this way they are often responsible for the death of fruit trees.

The bulletin in question contains instructions for combating this pest, legal regulations regarding hunting in the various States, formulae for the preparation of poisoned baits, and descriptions of two traps (Welhouse and Walmsley) used successfully for catching these rodents.

(1) See also *B.* Sept. 1915, N. 993.
(2) See also *B.* Feb. 1914, No. 190. (*Ed.*).

Alfredo Ruggeri, *gerente responsabile*.

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

# INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (*Ed.*).

FIRST PART.

# ORIGINAL ARTICLES

## Organisation of Agricultural Services in the French Zone of the Empire of Morocco.

by

M. MALET

*Director of Agriculture, Commerce and Colonisation.*

*General Residence of the French Republic in Morocco.*

In Morocco the agricultural question owes its importance to the fact that in an average year 98 per cent of the total exports consist of the produce of the soil.

At the same time that the French occupation was gaining for the native tribes that security which is necessary for all permanent agricultural work, the Intelligence Board (a military organisation) was endeavouring to give a fresh impetus to agriculture by the establishment of demonstration fields and nurseries, by seed distribution etc. Appreciable results were obtained, but as these initial efforts could only be applied on a restricted scale, they were insufficient to meet the many needs which arise from immigration and the extension of foreign business.

Agricultural colonisation involved the cooperation of European and native elements in the work of economic improvement and the union of districts that tribe rivalry had hitherto kept in isolation. Under these circumstances, it was inevitable that various technical and administrative problems should arise. Consequently it was necessary to form a central organisation attached to the General Residence in order to secure some measure of uniformity and permanence in matters connected with agriculture and stock breeding. The Agricultural Board was established on April 1st 1913 and its general programme may be analysed as follows:

1) To study the natural conditions of plant and animal production ;

2) to encourage improvement in native agriculture to the same degree as in neighbouring colonies ;

3) to advise and aid the colonists ;

4) to prepare the way for future progress by scientific investigation ;

5) to study the problems of agricultural hydraulics and improvement of land ;

6) to aid in the organisation of professional agricultural teaching ;

7) to establish administrative relations with the Chambers of Agriculture and with the Agricultural Societies and Committees.

In order that this programme might be more efficiently carried out the Agricultural Board was extended and developed in 1915 into the Department of Agriculture, Commerce and Colonisation, which now includes branches for Agriculture, Stockbreeding, Hydraulics and Agricultural Improvements, Colonisation, Research and Education, and also the official chemical laboratory for the analysis of samples.

The Agricultural branch, with which we are specially concerned here, includes a central board and a regional technical board.

*Central Board.* — This consists of :

1) an administrative staff which is concerned with office work and the study of legislative measures and regulations for the protection and improvement of agriculture.

2) a supervising staff which directs and controls the action of the regional board.

*Regional Technical Board.* — This consists of a technical staff drawn from the ranks of the inspectors and sub-inspectors of agriculture, the agricultural advisers and head and under gardeners.

Inspectors and sub-inspectors of agriculture are stationed in the chief centres (Mequinez, Casablanca, Mazagan, Marakesh), and they act as technical advisers to the military and civilian governing bodies, forming a connecting link with the Central Board in agricultural matters. These inspectors continually travel about the country and so they are able to take part in enquiries and surveys, to gather on the spot much useful information about the economic possibilities of their own areas, to carry out constant propaganda work and to spread information among the natives. They also instruct the colonists and advise them how to set to work, and finally they give to the experimental gardens and demonstration fields a bent which is practical and in line with the interests of the districts for which they have been established.

Every country which is desirous of making agricultural progress nowadays considers it necessary to establish experimental gardens specially adapted for teaching purposes. In West Morocco it has been possible to set up three such gardens at Rabat, Mequinez and Marakesh.

The garden at Rabat has been in working order since April 1st 1914 ; at first it was about 10 acres in extent, but it has since been granted a further 12 ½ acres. The work of this station is chiefly devoted to kitchen garden and fruit cultivation. These are already among the chief resources of the immediate neighbourhood of Rabat and the coast region, and their importance promises to be still greater in the future. In ad-

dition to this, experiments are being made on the growing of cotton, Riga flax, ramie, castor oil etc. Special attention has also been given to the building up of nursery collections which already include a fairly large number of varieties of fruit, forest and ornamental trees: Algerian olives eating grapes, hybrid vines from the Montpellier School, apricots, peaches, plums, apples, pears, walnuts, bananas, willows and screen-plants, etc. obtained from South France, Algeria, Tunis and Spain.

The Mequinez garden covers an area of 50 acres and was started in October 1914; on July 1st the same year the Marakesh station, 75 acres in extent, was placed at the disposal of the Agricultural Board. These two stations are given over to the production on a large scale of better varieties of fruit and woodbearing trees, of local or foreign origin. It has been possible to distribute a certain number of plants to the natives, who are the first to recognise the value of the extension of tree growing. Both gardens, also carry out experiments with commercial plants used in native industries (textile plants, essential oil plants etc.)

Two Experimental Farms are being set up, one, situated at the Fez gates, is 1 250 acres in extent; the other, about 7 ½ miles from Mazagan, covers 3 000 acres. They will begin by working along the lines of the present agricultural campaign, and will be able to deal with the larger agricultural problems which will present thenselves in connection with future colonisation and which would be outside the scope of the stations at Rabat, Mequinez and Marakesh. The work will include cereal selection for increase in yield and greater resistance to disease, the study of forage and commercial plants, questions connected with the working of the soil, utilisation of water, employment of machines, improvement of live stock employment and education of the labourer. Such problems as these can only be efficiently dealt with where sufficient land is available and where the work is carried out methodically and steadily under the conditions and with the resources that are available on an ordinary farm.

*Meteorology.* — A knowledge of the climatic characteristics of the country is of capital importance and the value of methodically registered observations has been recognised by the Department of Agriculture, which has already established 45 meteorological stations in Morocco, while another dozen are now being set up. The observations already made have been worked out at Rabat and issued in the official Bulletin, and they indicate the most important features of the climatology of this region.

The network of stations will be completed as soon as circumstances permit and will ultimately include:

1) a central station at Rabat, fully equipped with the best apparatus;

2) a well-equipped station in each natural district, supervised by the Inspector of Agriculture;

3) smaller stations provided with a certain number of instruments;

4) observation posts for the special purpose of measuring rainfall and temperature.

*Improvement of native agriculture.* — It will be a work of time to study the conditions under which various crops and methods of tillage, which have already been proved successful in other countries under similar conditions, can be introduced into Morocco. Organised agricultural experiments were begun at once but several years must elapse before the results are available. It was, therefore, of immediate importance to introduce to the native population simple and practical improvements in the methods of cultivation, most of which are in use in neighbouring colonies. This work has dealt with the pruning of fruit trees, especially the olive, in the regions of Mequinez, Fez and Rabat. The native proprietors have repeatedly shown how great an interest they take in our demonstrations and how much they wish for the continuation of the teaching, of which they begin to see the utilitarian value. With such good will and aptitude on the part of the scholars, associations of pruners and grafters will soon be formed, who will in their turn spread the better methods. In the same way it has been possible to begin to combat the sooty mould of the olive, which is so widely spread in Morocco.

Mechanical mowers, seed sorters and winnowing machines have been placed at the disposal of the different Regions in order to familiarise the native with the use of these implements, which are easily worked and are not expensive. The spread of the practice of cutting and drying the hay would bring about a great improvement in the rural economy of Morocco, where the grass is left to dry uncut without profiting anyone. By the use of seed sorters the natives learn the advantages of sowing large uniform seeds, free from weed seeds ; they are also taught how to prevent the smut or bunt of cereals by immersing the grains in copper sulphate solution.

*Cattle Breeding.* — The cattle breeding problems are closely allied to those which arise in the crop production ; consequently they have been entrusted to a Board under the immediate authority of the Director of Agriculture, Commerce and Colonisation, with the exception of those questions which concern army horses, which are dealt with by the Metropolitan Board of Studs and Army Remounts. At Casablanca, under the chief of the Board, a bacteriological veterinary Laboratory is prepared to undertake scientific research on parasitic and other diseases.

The Board of Regional Inspection has a veterinary surgeon in several centres, i. e. Mechra-bel-Ksiri, Mequinez, Fez, Settat, Marakesh ; these veterinary surgeons make frequent rounds for study and enquiry, which give them the opportunity of coming into close relations with the agricultural population and of encouraging better methods of stock management. Epizootic diseases are also under their control, and in co-operation with the municipal veterinary surgeons in the urban centres, the Board provides the Sanitary police for the interior of the country. The inspection of animals and animal products of foreign origin is carried out

at the ports by veterinary surgeons provided with special powers and remunerated by visiting and quarantine fees.

The chief steps that have been taken up to the present have dealt with the formation of forage reserves, the establishment of watering places in the chief cattle districts and along the main transport routes, and the building of shelters for the animals. Restrictions have been imposed on slaughtering, so that cows may not be killed under eight years and ewes under five years and steps have been taken against epizootic maladies. Premiums have been offered for cattle breeding, and facilities have been provided by the introduction of picked breeding stock into the country. The formation of a Stud-book and Herd-book is also under consideration.

An ostrich farm exists at Mequinez under the direction of the Veterinary Inspector of the Region.

*Laboratory of Agricultural and Industrial Chemistry.* — This was established at Casablanca in 1914 and is chiefly concerned with the suppression of fraud and adulteration in food and agricultural products. Even at the present stage of its development this Laboratory has made a useful contribution to the work of the Experimental Stations and Gardens, and this contribution will be still greater in the future.

*Hydraulics and Land Improvement.* — This Board is in process of formation and will deal with questions of drainage, the best use of water for agricultural purposes etc. The draining of the Merdjas (marshes) which cover a great part of Morocco will bring into use much land of first class quality.

*Research and Education.* — This branch was at first autonomous, but was united to the Agricultural Board at the time of the transformation into the Department of Agriculture, Commerce and Colonisation. This union was essential because in Morocco (as also in Algeria, Tunis, and Indo-China), agricultural production plays such a great part in affairs that a natural connection has arisen between agricultural and commercial interests, calling for the centralisation of the administrative study of the questions concerned. The Board has Regional Economic Bureaux which collect facts bearing on commerce and industry and study the causes which influence development. These bureaux possess commercial museums exhibiting the chief types of products, both imported and exported.

*Colonisation.* — This work has been somewhat hindered by circumstances, but the scheme embraces the following types of colonisation:

*a*) The demands of the towns for fruit and vegetables are continually increasing, and this provides a very favourable opportunity for the establishment of market gardens on the best soils as near as possible to the outskirts of the towns. Allocations of land for this purpose have already been made at Kenitra, Fez, Rabat-Sale, and Casablanca, and others are being considered.

*b*) As soon as new lines of railways are projected areas of land not exceeding 50 acres in extent will be let out in the immediate neighbourhood of the lines.

*c*) Provision has been made for the distribution of lots of land from 250 to 325 acres in extent, suitable for conversion into farms. Facilities for payment are given, subject to certain conditions as to working and improvement.

*d*) The Administration will lend its aid to large estates which are prepared to subdivide their property for the creation of farms for immediate cultivation. For this purpose assistance will be given for the building of communication roads and for the provision of a stock of public implements and machinery.

*e*) Special areas of land will be reserved for the native elements and efforts will be made to extend the work of the native provident societies in checking usury, and to develop the spirit of cooperation in the buying of seeds, implements and breeding stock.

SECOND PART.

# ABSTRACTS

## AGRICULTURAL INTELLIGENCE

### GENERAL INFORMATION.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

1157 - **The Agricultural Resources of Indo-China.** — BRENIER H. in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Vol. 126, No. 4, pp. 37-73. Paris, July-August 1916.

*Forest Products.* — Though there are possibilities of opening up a considerable trade with China in the hard woods, at present there is no timber in Indo-China suitable for export to the European markets with the exception of " lim " (*Erythrophleum Fordii* Oliv.) which is the material used for wood block-paving. Exports of forest products consequently consist almost entirely of bye-products, the principal ones being :

Cinnamon.
" Cunao " (tubercles of the Discoriaceae family from which a dye is obtained).
Cardamones (fruits of several Zingiberaceae).
Benzoin.
Guttapercha
Sticklac (1).
Rattans for fine canework.
Palm wood for unbrella handles.
Vegetable lac (obtained by tapping trees of the Anacardiaceae order).
Oil seeds of *Calophyllum Inophyllum* Lin., *Camellia drupifera*, Lour and *Garcinia*.
" Abrasin " (a drying oil probably obtained from *Aleurites montana* Wils.)
Camphor
Resin (from *Pinus Massoniana*).

Mangroves abound on the coast and might be made to produce considerable quantities of bark of an exceptionally high tannin content, some samples having yielded up to 24 to 25 per cent of tannin.

(1) See *B.* August 1916, No. 895.

*Animal Products.* — It would probably be possible to develop an export trade from Cambodge and Southern Annam. Exports of raw hides had already reached 3000 tons in 1913.

*Food Stuffs.* — After Burmah, Indo-China is the most important rice exporting country in the world and judging from the results obtained at the Experimental Station of Buitenzorg (Java), the production could be raised 50 per cent by the use of improved varieties. Maize is now being grown for export and an experimental ground has been set aside in Tonkin to investigate problems in connection with this crop. Small quantities of manioc and arrowroot are put on the market and could well be increased. Various kinds of pulse crops have been tried with success in Tonkin, the most popular at present being gram (*Cicer arietinum*).

Tropical fruits give promise of great future developments. With cold storage facilities, mangoes, mangostans and pineapples could easily be put on the European markets, while a profitable commerce could no doubt be established in preserved papaya fruit (valuable for its peptic ferment papain) and dried " letchis " (*Nephelium Lit-Chi*). Coffee and tea have been successfully planted and may become important in the more or less remote future, but cocoa is at present almost unknown in the colony, though suitable localities for its growth exist in Cambodge around the Gulf of Siam. Pepper is already being exported in considerable quantities, and so is cane sugar, though the latter industry is not in a very flourishing condition, its only experimental station (in central Annam) having been recently shut down.

*Fibres.* — Cambodge cotton is of a good fine quality though not up to Louisiana varieties in length of fibre and tensile strength. It is all exported to Japan. Good progress has been achieved in the silk-worm industry and Tonkin silk now competes with Canton products on the European markets. The Experimental Station at Phulangthoung distributes selected graine from which yields of 1 lb. of silk per 13.5 lbs of cocoons have been obtained or about twice as much as the native varieties produce.

Jute has been given a long but unsuccessful trial in the colony, ramie (*Boehmeria nivea* and *B. tenacissima*) is found sporadically, and *Hibiscus cannabinus* is indigenous to the country but its cultivation does not offer commercial openings at the moment. Kapok is obtained from *Eriodendron anfractuosum* and *Bombax malabaricum* and is exported together with coir.

A certain amount of material is sent to Europe for the rush and cane industries, i. e. various rushes, rattan canes and the leaf fibres of palms, *Livistona sinensis*, *Chamœrops* etc. Bamboo pulp for papermaking is now being manufactured at Vetri, a place situated at the junction of the Red and Claire Rivers.

*Oils and Fats.* — Copra is produced in Cochin-China, ground-nut in central Annam and castor oil seed in Tonkin. The colony also exports sesame seed and hevea seed which contains about 42 per cent of a drying oil somewhat similar to linseed oil. There are districts in Upper Tonkin where hemp and colza could no doubt be grown with success.

*Various Other Products.* — The most important of these is plantation rubber. In 1913 as much as 29 300 acres were under heveas, representing capital sunk to the value of £ 800 000. Exports in 1914 amounted to 180 tons.

Finally as worthy of possible future developments the following materials should be mentioned: tobacco, to be grown for the French Government monopoly ; various essential oils and extracts such as badian, citronella, vetiver, lemon grass, ylang-ylang, galangal, camphor ; catechu ; coca ; and lastly agar-agar to be obtained from certain seaweed beds on the coast of Annam.

1153 - **Agriculture in Switzerland.** — I. DESERENS E., Les améliorations foncières en Suisse, in *La Vie agricole et rurale* Year VIII, No. 36 (Special number on Swiss agriculture), pp. 161-164. Paris, September 2, 1916. — II. BORGEAUD A., Le bétail bovin en Suisse. *Id.*, pp. 164-172. — III. FREY J., Les coopératives d'élevage du bétail en Suisse. *Id.*, pp. 173-175. — IV. BOUKET D., La chèvre en Suisse. *Id.*, pp. 176-180. — V. PORCHET F., La viticulture en Suisse; ses rapports avec l'Etat. *Id.* pp. 184-185. — VI. Le régime des forêts en Suisse. *Id.*, pp. 184-185. — VII. PENEVEYRE F., La culture fruitière à la montagne, spécialement dans les Alpes et le Jura Vaudois. *Id.*, pp. 186-188..

The area of cultivated land in Switzerland is so limited and its value is so high that the State takes an active interest in all schemes of reclamation or improvement. A government service has been instituted for the purpose of assisting any such schemes and the writer is at the head of the section for the canton of Vaud.

All the available arable land is liable to flooding and to damage by erosion and landslips. For this reason as early as 1807-1816 the Federal Government took part in the first scheme for the regulation of watercourses, *i. e.* the embankment of the River Linth. Since then it has assisted in the work of regulating the water system of the Jura and its adjoining plains, and in many other schemes of a similar nature. During the period 1872 to 1911 the federal inspectors of Public Works sanctioned the expenditure of no less than £ 9400 for such purposes. The results have been excellent for the Canton of Saint-Gall, in three cases the value of the land has been raised to the extent of £ 27 per acre, while in the valleys of the Rhine, Linth and Seez an expenditure of £ 52 000 actually produced improvement valued at £ 134 000.

Drainage was first practised about 1850 and two years later Friburg passed a law making the drainage of bogs compulsory. In some cantons diplomas were granted to men who showed special proficiency in such work.

Over the whole of Switzerland, peasant proprietors are the rule and the holdings are very small. Out of a total of 252 496 holdings 201 919 range from 1 to 2 ½ acres, and not only are they too small but each holding consists of several scattered plots, the 201 919 in question being made up of nearly three million plots averaging 0.6 of an acre each. In some cantons the necessity of redistributing the area has been felt for the last thirty years, and the idea has gradually been extended over the country, so that now, if in any part of Switzerland two thirds of the holders, holding no less than one half of the land between them, agree to make

a rational redistribution of the land they have the legal right to enforce the reform.

The improvement of the mountain holdings is encouraged not only by the federal and canton governments, but also by numerous associations formed for that purpose. Such improvements consist in draining, harrowing and manuring the soil ; in collecting and removing stones ; in the building of roads, houses and farm buildings ; in the putting up of fences ; and in the regulation of surface water. Between the years 1885 and 1912, over £ 560 000 was spent on work of this kind.

With regard to the granting of financial assistance for the various schemes for agricultural improvements and reclamation, the Federal Government goes on the principle of helping those who help themselves and only subsidises schemes towards which the canton have contributed one half the estimated cost. The distribution of grants and subsidies since 1885 has been as follows :

| | Total cost | Sum contributed by Federal Government | Sum contributed by Canton Government |
|---|---|---|---|
| | £ | £ | £ |
| *Lowland reclamation* 1885-1912 : | | | |
| Drainage and irrigation (53 000 acres) | 532 000 | 155 000 | 126 000 |
| Construction of roads (140 miles) . . | 91 000 | 26 000 | 18 500 |
| Redistribution of land among small-holders (170 000 acres) . . . . . | 112 000 | 41 000 | 29 000 |
| Other improvements . . . . . | 93 000 | 25 000 | 20 000 |
| | 828 000 | 247 000 | 193 500 |
| | 464 000 | 162 000 | 109 000 |
| *Mountain reclamation.* . . . . . | 1 392 000 | 409 000 | 302 500 |

Since 1893 the Federal Government has also undertaken to pay part of the salaries of the agricultural experts engaged by the cantons.

II. — The total head of live stock in Switzerland has been valued at £ 28 000 000 and the importance attached by the government to this branch of agriculture is shown by the fact that the state grants a sum of £ 40 000 per annum for the encouragement of pure breeding.

In all live stock shows, judging is carried out exclusively by the system of score cards, a sample of which is given in the adjoining table, and great stress is laid on pedigree which counts for half the total number of possible points, as follows :

| Out of 100 possible points, | |
|---|---|
| 16 points | are allowed for the 2 parents or 8 points for each |
| 16 points | " " " 4 grandparents or 4 points for each |
| 16 points | " " " 8 greatgrandparents or 2 points for each |
| 48 points | " " " whole pedigree. |

## *Score card for Simmenthal cattle.*

### Bulls.

| cm. | Per cent | Good measurements for: 2 year olds and more | Good measurements for: Yearlings | Born ..... No. / Permanent dentition ..... | Max. | | |
|---|---|---|---|---|---|---|---|
| | | cm. | cm. | | | | |
| ..... | ..... | *29–33* | *30–33* | HEAD | 10 | | ..... |
| ..... | ..... | *15–16,5* | *15–16,5* | NECK | 3 | | ..... |
| | | | | TRUNK: | | | |
| ..... | ..... | *43–46* | *41–44,5* | Chest, length ..... 3 | | | |
| ..... | ..... | *43–46* | *43–44,5* | Chest, depth ..... 3 | 11 | ..... | |
| ..... | ..... | *30–33* | *28,5–32* | Chest, width ..... 5 | | | |
| | | | | Withers and shoulder . | 9 | ..... | |
| | | | | Line of the back ..... | 6 | ..... | |
| ..... | ..... | *23,5–25,5* | *23–25* | Back, belly and flank .. | 5 | ..... | |
| ..... | ..... | *32–35* | *32–35* | Rump, hook bones to hip joint ..... 2 | | | |
| ..... | ..... | *31–34* | *30–32,5* | Width of haunch ... 2 | 10 | ..... | |
| ..... | ..... | *30–33,5* | *30–33* | Width of hip joint .. 2 | | | |
| | | | | Shape and angle of croup ..... 4 | | | |
| | | | | Attachment of tail ... | 4 | ..... | |
| | | | | Length of hind quarters ..... | 4 | ..... | ..... |
| | | | | LIMBS: | | | |
| | | | | Foream and leg ..... | 2 | ..... | |
| | | | | Shinbones and hocks .. | 5 | ..... | |
| | | | | Pasterns and hoofs ... | 3 | ..... | |
| | | | | Carriage ..... | 5 | ..... | ..... |
| | | | | SKIN AND HAIR ..... | 5 | | ..... |
| | | | | COAT COLOUR ..... | 5 | | ..... |
| | | Height of withers | | GENERAL CONFORMATION, length of limbs, fineness of bone ..... | 6 | | ..... |
| ..... | ..... | *82–87* | *83–91* | | | | |
| | | Profection of sacrum | | | | | |
| ..... | ..... | *2–6* | *4–9* | GENERAL DEVELOPMENT (weight) ..... | 7 | | ..... |
| | | Height of knee | | | | | |
| ..... | ..... | *21–23* | *22–25* | | | | |
| | | Point of hock | | Total ... | 100 | | |
| ..... | ..... | *28–31* | *30–33,5* | | | | |
| | | | | Pedigree ..... | 50 % | | |

### Cows and heifers.

| cm. | Per cent | Good measurements for: 3 year olds and more | Good measurements for: 2 year olds | Born ..... No. / Permanent dentition ..... | Max. | | |
|---|---|---|---|---|---|---|---|
| | | cm. | cm. | | | | |
| ..... | ..... | *29–32* | *30–32,5* | HEAD | 10 | | ..... |
| ..... | ..... | *15–16,5* | *15–16,5* | NECK | 3 | | ..... |
| | | | | TRUNK: | | | |
| ..... | ..... | *42–44,5* | *41–44,5* | Chest, length ..... 2 | | | |
| ..... | ..... | *43–45,5* | *43–45,5* | Chest, depth ..... 3 | 9 | ..... | |
| ..... | ..... | *28–32* | *27–31* | Chest, width ..... 4 | | | |
| | | | | Shoulder and withers . | 7 | ..... | |
| | | | | Line of the back ..... | 4 | ..... | |
| ..... | ..... | *24–25,5* | *23–25* | Back, belly and flank .. | 4 | ..... | |
| ..... | ..... | *31–34* | *31–34* | Rump, hook bones to hip joint ..... 1 | | | |
| ..... | ..... | *32–35* | *32–35* | Width of haunch ... 1 | | | |
| ..... | ..... | *30–33,5* | *30–33,5* | Width of hip joint .. 2 | 7 | ..... | |
| | | | | Shape and angle of croup ..... 3 | | | |
| | | | | Attachment of tail .... | 4 | ..... | ..... |
| | | | | Length of hind quarters ..... | 3 | ..... | |
| | | | | LIMBS: | | | |
| | | | | Forearm and leg ..... | 2 | ..... | ..... |
| | | | | Shins and hocks ..... | 4 | ..... | ..... |
| | | | | Pasterns and hoofs ... | 3 | ..... | ..... |
| | | | | Carriage ..... | 5 | ..... | ..... |
| | | | | SKIN AND HAIR ..... | 5 | | |
| | | | | COAT COLOUR ..... | 5 | | |
| | | Height of withers | | UDDER AND MILKING POINTS ..... | 12 | | |
| ..... | ..... | *81–87* | *84–89* | | | | |
| | | Projection of sacrum | | GENERAL CONFORMATION, length of limbs, fineness of bone ..... | 6 | | ..... |
| ..... | ..... | *4–8* | *5–10* | | | | |
| | | Height of knee | | GENERAL DEVELOPMENT (weight) ..... | 7 | | ..... |
| ..... | ..... | *21–24* | *23–35* | | | | |
| | | Point of hock | | Total ... | 100 | | |
| ..... | ..... | *30–33,5* | *32–55* | | | | |
| | | | | Pedigree ..... | 50 % | | |

Outside crosses are not encouraged and improvement is obtained by the method of selection and in-breeding.

The characteristics of the four chief Swiss breeds—Simmenthal, Schwitz Friburg and Herens — are given in this article as well as their geographical distribution in the country.

III. — There are 850 cooperative live stock societies in Switzerland (1) amongst which the two chief breeds, Simmenthal and Schwitz, are distributed in about equal numbers.

IV. — Swiss goats have long had a very good reputation abroad and exports of the Toggenburg breed to England were begun as early as 1886. During the nineties goats were much improved by a careful selection of breeding stock without bringing in any foreign blood. The four chief breeds are: the Valaisian or Black Neck, the White Saanen or Gessenay, the Alpine, and the Toggenburg. There are a number of goat clubs, and during the years 1908 to 1910 the Federal Government granted the following bonuses to prize animals:

£ 490 to 1184 animals in 1908.
£ 570 to 1225 animals in 1909.
£ 650 to 1335 animals in 1910.

Swiss goats yield on an average 150 to 180 gallons per annum. In the valleys they are kept by the smallholders and graze the land near the homesteads, but on the higher ground there is usually a village goat-herd who collects the animals every morning and takes them to the upland pastures for the day, bringing them home again each evening. There are 115000 herds in Switzerland averaging 32 goats per herd. An active export trade is done with Germany where the Swiss breeds have given excellent results when crossed with the local German goats. The trade will probably be extended to France for the improvement more especially of those breeds found in the Central Plateau.

V. — The area of land under vineyards only amounts to 60 000 acres in Switzerland, yet there are two experimental stations set aside for purely vitieultural work. One is the Federal Station at Wadenswil and the other is run by the canton of Vaud at Lausanne. In other parts of the country special instruction is given in the form of short temporary courses which the Federal Government contributes to by paying one half the cost. Assistance is given by canton and Federal Governements to all cultivators who are willing to take protective measures against diseases such as mildew, or to insure themselves against damage by hail. Important subsidies are granted too for reconstituting the vineyards (*i. e.* replacing vines which are either attacked or liable to attack from phylloxera by varieties grafted on resistant American stock). Cultivators have received as much as £ 35 to £ 45 per acre for this purpose, half of which was

(1) See International Review of Agricultural Economics, Jan. 1916, pp. 47-56.

contributed by the local government and half by the central government. Swiss wines are protected by an import duty on all foreign wines.

VI. — Forests in the canton of Vaud are classified as follows:

*Public and private forests.* — Under the heading of private forests would also be included land owned by an association of small holders.

*Protective and non-protective-forests.* — Protective forests are those situated in the collecting areas of torrents or those which by their position exert a protective influence against storms, avalanches, rock-slides, landslips and erosions or which tend to regulate the flow of water from a mountain side.

*Mountain forests and lowland forests.* — The distinction between these two classes is merely an arbitrary division made locally by the communes at an altitude of 2500 to 3000 ft., and is not recognised in federa-edicts.

In every kind of forest whenever felling is in progress the replanting of a surface equal in area to the surface felled is made compulsory both by the federal and canton law. All trees to be felled must be previously marked and no clear felling is allowed without special permission from the local authorities. In the case of protective forests the Federal Government only can give leave for cutting and all operations must be carried out under the supervision of the local officer.

VII. — Various attempts dating as far back as the sixteenth and eighteenth centuries have been made to extend the area of orchards in the high parts of the canton of Vaud. In 1890 the Agricultural Institute at Lausanne imported a number of hardy varieties of plums, apples, pears and cherries from Russia, Sweden and Denmark, and nurseries were established at high altitudes (2500 to 4000 ft.) for their propagation. The following year a few small trial orchards were planted on Mount Jorat overlooking Lake Lehman at about 3000 ft. and when these were well started general planting was encouraged by means of practical demonstrations, lectures and by the free distribution of the new varieties.

The most successful kinds are given below:

| Apples | | Pears | Plums |
|---|---|---|---|
| — | | — | — |
| Red Astrakan | Borowinka | A variety imported | Rothdamasiner. |
| White Astrakan | Antonovka | under the name of | |
| Biali Naliv | Papierovka | Vineuse Saxonna | |
| Titovka or Tulska | | proved to be beurré de Montécat. | |

There are now flourishing orchards of Titovka, Antonovka and Papierovka at about 4000 ft. high.

1159 – **The Oxygen Consuming Powers of Natural Waters.** — HEISE G. W., and AGUILAR R. H., in *The Philippine Journal of Science*, Vol. XI, Sec. A., No. 1, pp. 37-47. Manilla, January 1916. RURAL HYGIENE

The oxygen consuming capacity of water as measured by its ability to reduce potassium permanganate is a sensitive means of detecting fluctuations in quality in a water supply, and gives comparable results when

a fixed method is strictly adhered to. In order to study some of the factors which influence the reaction a series of tests were carried out with river water drawn from the Manilla city reservoir and containing less than 5 parts per million of chlorides.

The first factor studied was the length of time allowed for the digestion. Samples of 200 cc were used and the tests were carried out at 100°C. The results are given in Table I.

TABLE I. — *Reduction of potassium permangate by water ; effect of varying the duration of digestion.*

| Duration of digestion | Permanganate required (1) |
|---|---|
| | cc. |
| Less then 1 minute | 0.82 |
| 15 » | 1.10 |
| 30 » | 1.27 |
| 45 » | 1.29 |
| 1 hour | 1.34 |
| 2 » | 1.75 |
| 4 » | 2.46 |

(1) 1cc = 0.1 mgm oxygen.

The decomposition showed no signs of reaching an end point after several hours digestion. The tests were then repeated at lower temperatures, but even at 10° C. the effect of the time factor was still marked although the difference between the four and eight hour digestion was negligible for practical purposes.

The effect of the presence of chlorides was next investigated. Samples of 100 cc were used this time and the digestions were kept going for 4 hours at 30° C. Some of the results are given in Table II.

TABLE II. — *Reduction of potassium permanganate by water ; effect of presence of chlorides.*

| Chlorine content (in parts per million parts water) | Permanganate required | Difference in permanganate required due to presence of chlorides |
|---|---|---|
| | cc. | cc. |
| 0 | 1.31 | — |
| 5 | 1.38 | 0.07 |
| 10 | 1.46 | 0.15 |
| 20 | 1.48 | 0.17 |

The error due to the presence of chlorides persisted even when digestion was carried on at a moderate temperature. This error was reduced, although not eliminated, if digestion was carried out at or below room temperature and if the final titration of excess potassium permanganate was made with sodium thiosulphate in the presence of potassium iodide and starch indicator. It was further reduced by digesting the water samples with potassium permanganate in alkaline instead of acid solution according to the method described by SCHULZE, and WINKLER (1).

A last series of tests was undertaken to determine the effect, if any, of the presence of traces of hypochlorite in the water. It was found that hypochlorites oxidize organic matter in cold or hot solution and should therefore be eliminated before any determination of the oxygen consuming power is made.

From these results it is evident that the determination of oxygen consumption is not at best an accurate measure of the organic content of water and it gives such uncertain results that isolated determinations are of very little value. It is only when a water supply is to be consumed repeatedly that the method becomes very useful.

1160 – **Immunity to Cow Pox as a Result of Intravascular Infections.** — CAMUS L., in *Comptes Rendus des Séances de l'Academie des Sciences*, Vol. 163, No. 14, pp. 338-340. Paris, October 2, 1916.

A series of experiments were carried out with cow pox vaccines in order to determine the length of time, if any, which must elapse between inoculation and immunisation. A very pure vaccine was injected into the veins or arteries of rabbits, and immunity was tested by local reactions. The results show that the time required for immunisation varies inversely with the amount of vaccine injected, so that though it may not be possible to suppress completely the latent or incubation period, it is easy to modify its duration. Individual differences in the subjects are far less important than the amount of vaccine used. Other investigators (BOUSQUET, HUSSON, HEIM and GREGORY) who have not taken into account either the activity of their vaccine, or the size of their doses have obtained very contradictory results with regard to the period of incubation, and the above experiments offer a satisfactory explanation of the discrepancies recorded.

1161 – **The Royal Institute for Agricultural Experiments Tripoli.** — MANGANO G., in *Ministero delle Colonie, Ufficio Economico, Bollettino di Informazioni*, Year V, Nos. 1, 2 and 3, pp. 7-122. Rome, January, February and March 1916.

EXPERIMENTAL AND ANALYTICAL WORK

One of the first duties of the Agricultural Department (" Ufficio Agrario ") of Tripoli has been to found an experimental station for the improvement of existing agricultural practice in the colony and to extend the area of cultivated land. The station was established in the autumn of 1914 at Sidi el Mesri, on the outskirts of the city of Tripoli, where build-

(1) See *Dingler's polytech. Journal* (1868) 188, 197; *Zeitschrift für analytische Chemie* (1914) 53, 561 (*Ed*).

ings had been already erected for an agricultural school by the Turks. Temporary accommodation is there provided for a metorological observatory, a museum and library, chemical and botanical laboratories, and for the necessary scientific and administrative staff. Store rooms, stables, implement sheds, cattle sheds and cottages for the servants and workmen are grouped round the main buildings ; also a good covered well fitted with an electric pump and a reservoir of 2000 gallons capacity.

The experimental ground is divided into :

1) A *park* where varieties of trees and shrubs are tested for sylvicultural, ornamental and protective purposes. Thirty eight kinds are at present on trial and this number will be greatly increased as time goes on.

2) A *dry orchard* for fruits which are likely to prosper without irrigation. These consists of :

| | |
|---|---|
| Peaches | Apricots |
| Walnuts | Almonds |
| Figs | Quinces |
| Loquats | Pears |
| *Zizyphus* spp. | Cherries |
| Pomegranates | Table olives |
| Carobs | Eucalyptus |
| Casuarina | |

3) An *irrigated orchard* which is also provided with efficient wind screens. It is planted with all the fruits of the dry orchard except carobs, casuarina, olives, and eucalyptus, and has in addition :

| | |
|---|---|
| Lemons | " Kin Kans " |
| Bergamots | Kumquats |
| Limes | Citrons |
| Oranges | Custard apples |
| Tangerines | Avocados |

4) A *dry almond orchard* to test the possibility of establishing such trees on the dry steppe.

5) A *dry olive grove* consisting partly of an old established plantation and partly of a new plantation of native and Italian varieties.

6) An *irrigated palm grove* in which all the varieties of North African dates are eventually to be collected for purposes of classification. At present 47 kinds of *Phoenix dactylifera* ar egrowing there. These have been all obtained from the coastal region between Agilat and Tadjioura, and later, other parts of North Africa will be explored to provide new material for study.

7) A *dry vineyard* for testing species and varieties of Italian grapes suitable for use as table fruit or as dried fruit. The climate of Tripoli should be well adapted to the production of the earlier varieries of such grapes.

8) A *plantation of prickly pears* on particularly arid soil where

Tunisian, Sicilian and American varieties of the two types of plants will be raised — the spineless type as a fodder plant and the spiny kind for hedging.

9) *A field for cereals* which at present consist of a few obscure varieties of local barley and some native and Italian varieties of wheat.

10) A *field for fodder plants* where hairy and common vetches, vetchling (*Lathyrus sativus*), fenugreek, sulla or Spanish sanfoin, chloris, and taff are being tried without irrigation. A small plot of mangels is also under experiment.

11) A *field for irrigated crops* which is principally occupied by lucerne, the rest being under tobacco. Of the latter the Turkish varieties Giant Herzegovina, Porsucian, Xanthi jaka, Aya Sluk and Samsoun, also Virginia bright and Java have been under trial and these not only at Sidis el Mesri, but also on various other estates.

As the coastal region has proved well adapted to the growth of mulberry trees, the question of introducing the rearing of silkworms on the oasis farms is full of interesting possibilities. As a start a few experiments have been carried out with graine of the Pyrenees, Grand Sasso, Polyjaune, Istria Yellow and native Yellow *C* and *F* breeds, and the crosses Chinois or × Bijaune and Bijaune or × Batoum Yellow. The results have been most encouraging.

So far as irrigation problems are concerned, the Institute is at present investigating wells and water lifting apparatus for use on the different kinds of farms. In the immediate district of Sidi el Mesri two wells have already been dug and three others have been deepened and put into working order. But progress in the establishment of water raising plant is slower as the systems in use are numerous and varied and the individual merits of each have to be determined. Those at present under construction are :

The Arab system of counterpoise or shadoof.
The noria or endless chain with buckets, worked by horse gear.
The windmill with force pump.
The Archimidean screw worked by motor.
The compressed air pump.
Electric pumps of high and moderate power.

The Institute also proposes to take up the difficult problem of reclaining the sand dunes, both with a view to extending the area of productive land and of protecting the more inland tracts from blown sand. An experimental ground has already been set aside for testing the various plants and trees which are known to have a binding effect on the surface and which at the same time may be made to produce useful crops.

The department dealing with live stock has not yet been created, but will eventually undertake research on : the native breeds of all classes of farm animals (including horses, cattle, dromadaries, camels, donkeys, sheep, goats, pigs, ostriches, and poultry) and the possibility of improving them by selection and by crossing with suitable imported breeds ;

the harvesting, storage and feeding value of forage crops ; the commoner diseases of live stock and means of checking and preventing them ; systems of management and breeding and the returns to be obtained from each. The Institute itself will endeavour to keep a large head of all kinds of breeding stock to be drawn upon by other parts of the colony as required ; also demonstration flocks and herds to be run on economic lines. Extensive trials will be carried out at one of the special farms mentioned below on the management of animals turned to pasture.

A nursery has been established within two miles of Sidi el Mesri to provide stock for the Institute and for distribution to sub-stations and to native and Italian farmers. Olive trees (of the Tripoli, Tunisian and wild varieties), Seville oranges, bitter almonds and various forest trees are already being cultivated as well as certain fruit trees and bushes. Plots are also prepared for raising special strains of lucerne and tobacco.

The complete project of the Tripoli Institute includes the creation of two demonstration farms. One of these, in the region of Tarhouna, will specialise in the production of cereals and the grazing of live stock. The other, which has already made a start, is situated at Sabrata (district of Agilat) in the middle of a large area of good steppe soil, with a reasonably high water table. This area is crossed by the railway and enjoys a good climate so that the conditions are eminently adapted to the foundation of a big Italian farming colony. The type of farming proposed is one consisting chiefly of irrigated plantations, though the proximity of the water to the surface makes it possible not to exclude irrigated crops. Further, the settlement will afford a good opportunity of testing a system of land tenure which is very suitable to North Africa and might lead to the planting up of much land which is at present only producing the poorest pasture and an occasional barley crop. By this system, which is known as the " mougharsa ", the landlord leases the land to a tenant for a number of years (usually ten), and during that time the tenant pays no rent, but is obliged to do a certain definite amount of planting, to build a house and to dig a well. At the end of the given period, the whole property is divided up equally between the landlord and the tenant. At Sabrata, the obligations of the tenant will consist in the formation of an olive grove, the planting of almonds and other fruit trees — all unirrigated — and the making of a small irrigated garden and orchard where the tenant can grow a large part of his own food.

The establishment of a government experimental farm for irrigated crops has had to be postponed owing to the present scarcity of labour, but there are a number of Italians and natives already running their own irrigated farms and these will serve to guide intending settlers who want to learn something about possible returns from irrigated crops.

1162 – **Recent Investigations at the Imperial Institute, London: Whales' Bones from the Falkland Island; Naked Barley from Cyprus; Edible Beans from Burmah; Paper-Making Materials from South Africa; African Silk.** — *Bulletin of the Imperial Institute*, Vol. XIV, No. 2, pp. 149-181 and 261-267. London, April- June 1916.

*Whales' bones from the Falkland Islands.* — The whaling industry of the Falkland Islands and its Dependencies (South Shetlands, Graham's Land, South Orkneys and South Georgia) is now the most important in the world. In the 1913-1914 season 9429 whales were caught, the total value of the products being £1 301 548. The bones, which accumulate in enormous quantities, were formerly thrown away, but are now boiled down with the flesh to extract the oil, and the residue is converted into manure. In the 1913-1914 season, 1327 bags of bone meal valued at £570 were produced in South Georgia, while the entire Colony and its Dependencies in the same year produced 94 835 bags of whale guano valued at £47 887. An average sample of the bones reduced to a meal was analysed at the Imperial Institute with the following results which are shown in comparison with those recorded for commercial raw bone meal:

| | Whales' bone meal — Per cent. | Raw bone meal — Per cent. |
|---|---|---|
| Moisture | 7.30 | 8.80 |
| Organic matter | 40.40 | 34.94 |
| containing nitrogen | 3.87 | 4.19 |
| " oil | 11.50 | about 10 |
| Phosphoric acid | 20.24 | 21.66 |
| Lime | 24.06 | 28.53 |
| Magnesia etc. | 7.39 | 4.62 |
| Siliceous matter | 0.61 | 1.45 |

*Naked Barley from Cyprus.* — In a sample of skinless barley received from Cyprus, the grains varied in size, were of a light brown colour and had a dull translucent appearance. Their germinating power was 96 per cent within 5 days. The barley was analysed and compared with English and Azof varieties with the results given in Table I.

This naked barley could not be employed for malting purposes but possibly might be used by distillers. Also it ranked as a good class of feeding barley and might be employed for blending with other feeding stuffs. In March 1916 it was valued at from £2 10*s* to £2 12*s* 6*d* per 480 lbs. c. i. f. London.

*Edible beans from Burmah* (1). — Experiments have been carried out at Mandalay, Burmah on the cultivation of Lima beans (*Phaseolus lunatus*) which were introduced from Madagascar and California in 1912-1913 and of tepary beans (*P. acutifolius*) which were introduced from the United States in 1914-1915. The first crop of Madagascar Lima beans contained more prussic acid than the original seeds (0.0025 to 0.008 as against 0.002

(1) See *R.* 1916, No. 5. (*Ed.*)

TABLE I. — *Composition of naked barley from Cyprus.*

| | Naked barley | English barley | Azof barley |
|---|---|---|---|
| | Per cent | Per cent | Per cent |
| Moisture | 10.4 | 14.9 | 12.9 |
| Total nitrogenous substances | 11.5 | 8.0 | 12.3 |
| True proteins | 10.3 | — | — |
| Other nit. subs. | 1.2 | — | — |
| Fat | 1.9 | 1.5 | 2.5 |
| Carbohydrates | 72.4 | 68.5 | 65.1 |
| Fibre | 1.8 | 4.5 | 4.4 |
| Ash | 2.0 | 2.6 | 2.8 |
| Albuminoid ratio | 1 : 6.7 | 1 : 9.0 | 1 : 5.7 |
| Food units | 106 | 92 | 102 |

TABLE II. — *Composition of tepary beans, of Voandzeia subterranea beans and of the residual meal from water-melon seeds.*

| | Tepary beans | *V. subterranea* beans | Residual meal from water-melon seeds |
|---|---|---|---|
| | Per cent | Per cent | Per cent |
| Moisture | 12.0 | 8.25 | 9.5 |
| Total nitrogenous substances | 23.6 | 21.3 | 18.3 |
| True proteins | 20.6 | 19.8 | 17.5 |
| Other nit. sub. | 3.0 | 1.5 | 1.0 |
| Fat | 1.8 | 5.9 | 0.5 |
| Carbohydrates | 57.2 | 58.1 | 26.9 |
| Fibre | 2.7 | 3.2 | 41.9 |
| Ash | 3.2 | 3.3 | 2.9 |
| Albuminoid ratio | 1 : 2.9 | 1 : 3.4 | 1 : 1.5 |
| Food units | 119 | 127 | 74 |

to 0.0025) ; in subsequent crops this high content was considerably reduced though it still remained above that of the imported beans. It would appear from the results obtained that the prussic acid content is affected by the weather conditions, but not, on the other hand, by the nature of the soil on which the crop is grown. The Californian Lima beans yielded seed smaller than the original sample and containing 0.0045 per cent of prussic

TABLE III. — *Chemical examination of tambookie grass from the Transvaal and papyrus from Zululand.*

| | Tambookie grass | Papyrus | |
|---|---|---|---|
| | | Stems and leaves | Stems only |
| | Per cent | Per cent | Per cent |
| Moisture (on drying at 100°–110°C) | 10.2 | 12.1 | 11.6 |
| Ash (expressed on dry material) | 7.4 | 6.0 | 9.4 |
| Yield of unbleached pulp (dried at 100°–110°C.) | | | |
| Expressed on air-dry material | 37.1 | 21.2 | 22.5 |
| » » material dried at 100°–110C. | 41.3 | 24.0 | 25.5 |
| Loss in weight of pulp on bleaching | 3.1 | 13.9 | 4.9 |
| Yield of bleached pulp (dried at 100°–110°C.) expressed on original material dried at 100°–110°C | 40.0 | 20.7 | 24.3 |
| | ins. | ins. | ins. |
| Length of ultimate fibres | 0.012 to 0.188 | 0.009 to 0.18 | 0.01 to 0.18 |
| Mean Length | 0.081 | 0.042 | 0.048 |

acid. They were valued at £12 to £14 per ton on a normal London market.

Tepary beans are said to be specially adapted to dry situations where other beans do not succeed, as they will bloom and set seed during periods of extreme heat, yielding a crop about four times as large as would be obtained from the kidney bean (*P. vulgaris*). The sample received from Burmah was in good condition ; it contained no alkaloids or cyanogenetic glucosides and compared favourably with haricot beans with regard to food value (Table II). On a normal London market it should be worth £10 a ton.

*Voandzeia subterranea beans from the Sudan.* — *V. subterranea* is a leguminous plant widely cultivated in tropical Africa for its seeds which form an article of native diet. Specimens of the beans from the Northern Provinces, Nigeria and from Zanzibar were examined at the Imperial Institute some years ago (1) ; the present samples were of rather better quality. Their composition is given in Table II. They contain no cyanogenetic glucosides or alkaloids and could be used for making compound foods at a price of about £4 per ton.

*Water-melon seeds from the Sudan.* — Water melons (*Citrullus vulgaris*) are cultivated on a considerable scale in Kordofan Province and a sample of the seeds was sent for examination to the Imperial Institute with a view to finding a market for them in London. The seeds contained

(1) See *B.* 1918 Nos. 1 and 5. (*Ed.*)

7.4 per cent of moisture and yielded 23.6 per cent of brownish yellow oil which had the following constants:

| | |
|---|---|
| Specific gravity at 15°C | 0,923 |
| Solidifying point of fatty acids | 30.5°C |
| Acid value (mgms. potash per 1 gm. oil) | 8.4 |
| Saponification value | 191.4 |
| Iodine value | 117.1 per cent |
| Hehner value | 95.1 |

The oil is very similar to that obtained from other cucurbitaceous seeds. The residual meal left after extraction contains no alkaloids or cyanogenetic glucosides; it has a high percentage of fibre and a low food value (Table II).

*Colocynth pulp from the Sudan.* — Colocynth is the name given to the peeled dried fruits of *Citrullus Colocynthis*, the material freed from seeds constituting the drug known in the British Pharmacopoeia as colocynth pulp. Before the war, it was largely obtained from Turkey and Austria and recently considerable quantities have been exported from the Sudan. The sample under examination was of good quality and was valued at 1s 3 *d* per lb.

*Papermaking materials from South Africa.* — Tambookie or tamboo-tie grass (*Cymbopogon Nardus* var. *vallidus*) is said to grow luxuriantly over large tracts of country in the Transvaal reaching a maximum height of 5ft. 6 in. The results of the chemical examination of the grass is shown in Table III. A high yield of pulp of good quality and easily bleached was obtained, and from it a strong paper was prepared. The grass was valued at £4 per ton.

A sample of papyrus from Zululand consisted of greenish yellow pithy stems averaging 7ft in length and 1 in. in diameter at the base, each with a tuft of narrow pointed leaves (about 14 ins. long) at the top. The proportion of stems to leaves in the sample was as 4 to 1. Results of the chemical examination are given in Table III. The yields of pulp are comparatively low, but the material might be used with profit if worked up near its place of production.

*African wild silk.* — The only African insects which produce silk in important quantities are those belonging to the different species of *Anaphe* (fam. *Eupterodidae*). The most important of these found on British territory are:

*A. infracta* in Nigeria and Uganda
*A. venata* in Nigeria and the Gold Coast
*A. moloneyi* in Nigeria
*A. ambrizia* in Uganda
*A. panda* in Natal
*A. reticulata* in Natal.

All these insects form silken nests or colonies within which each worm spins its own cocoon. The nests vary considerably in size and form;

they may be more or less spherical as in *A. infracta* and *A. venata* or flattened as in *A. moloneyi*. The envelope of the spherical forms usually consists of three thicknesses of silk: the outer layer more or less papery in texture; the middle layer, composed of loosely spun silk arranged in a number of superimposed sheets; the innermost layer, hard and parchment-like. The envelope of the flattened colonies is made up of a single layer of closely interlaced silk. The silk of both nests and cocoons is naturally brown in colour, but in the absence of light the worms produce a white silk, and for this reason the natives in parts of Nigeria sometimes enclose them in calabashes.

Anaphe silk cannot be reeled as is done in the case of silk from *Bombyx mori*, and it is therefore carded and spun as " waste " silk; but apart from this it more closely resembles *B. mori* silk than does any other kind. It takes dyes well and has been found useful for the manufacture of velvet, sewing silks and other materials. The degummed silk has been valued at about 1s per, lb but owing to the large amount of labour required to free the silk from extraneous matter, the crude material if shipped to the United Kingdom would only realize about 1*d* or 2*d* per lb. If however, the silk were cleaned locally by the natives, the clean product might be worth 6*d* per lb. in London.

It has been shown experimentally in Uganda that the worms can be successfully domesticated and there seems to be no reason why a new industry should not be established in Africa.

## CROPS AND CULTIVATION.

1163 – **Cause and Nature of Soil Acidity with special Regard to Colloids and Adsorption.** — TRUOG E., in *Journal für Physikalische Chemie*, Vol. XX, pp. 457-484 1916; abstract in *Journal of the Society of Chemical Industry*, Vol. XXXV No. 15, pp. 855 856. London, August 15, 1916.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

The production of acidity or alkalinity when certain neutral solutions come into contact with certain solids is probably due to chemical action and not to selective adsorption of ions. Cameron's contention that the acid reaction towards litmus of washed absorbent cotton (and inferentially of certain soils) is due to the adsorption of cations, is untenable, since such cotton has been found to contain an insoluble fatty acid (perhaps margaric acid), which would not be completely removed by the washings with alkali and acid. When cotton is brought into a neutral salt solution, the salt reacts with the fatty acid, some cations are removed and an equivalent amount of soluble acid liberated. Similarly, the reputed selective adsorption of ions by charcoal is accounted for by chemical actions between impurities contained in it and the dissolved salt.

Assuming selective adsorption, the vastly greater adsorptive power of soils would still need explanation. Arguments are also adduced to prove that soil acidity is not the result of selective ion-adsorption, by colloids or by finely divided solids; and it is shown experimentally that

under suitable conditions, the reactions causing soil acidity proceed according to chemical laws. The acidity in well aerated soils, in particular in cultivated upland soils, is due to the hydrolysis of silicates, of which the bases are removed by plants and by soil water, and to the silica and acid silicates left behind. The weathering process in soils can be reproduced by treating powdered basalt, granite felspar, etc., with carbonated water and filtering: the residues are acid to litmus. In dry regions the soluble salts accumulate and cause alkalinity. In these soils organic acids derived from plant residues are of little importance: they may be formed, but are quickly transformed. In badly aerated soils *e. g.* in peat soils, the plant remains are decomposed much more slowly; instead of being oxidised to carbon dioxide, much of the carbon remains in the soil in organic combination as the so-called humus acids, and eventually is transformed into coal.

The latent acidity of a soil may be largely due to kaolinite and similar compounds, or to free quartz; and the results of the determinations of active and latent acidity show that the amounts of different hydroxides that react with the insoluble acids, are approximately chemically equivalent. The fact that acid soils do not take up equivalent amounts of different bases from salt solutions possessing a common ion, is not opposed to the hypothesis that soil acidity is due to the presence of free acids, for the reactions involved would be much influenced by secondary reactions. By using small quantities of finely powdered soil and large volumes of salt solutions, and minimising the time of contact, the effect of such side reactions can be practically annulled; and determinations of soil acidity under these conditions give results which are best explained on the assumption of the existence of free acids. Further, the adsorption hypothesis would lead to the conclusion that the acidity of a soil would increase if the particles were ground to an impalpable powder: experiments showed a slight decrease.

OPENING UP LAND FOR CULTIVATION

1164 – **The Reclamation of Arid Steppe Soil and of Shifting Sands in the Province of Astrakan, Russia.** — Vysotzkif G., The flora of Ergenia and the conditions under which it is developed. *Труды Бюро по прикладной Ботаникѣ* (*Bulletin of Applied Botany*). Year VIII, Nos. 10-11, pp. 1113-1418. Petrograd, October-November 1915. — II. Firstov J. G., The shifting sands of the province of Astrakan. *Сельское Хозяйство и Лѣсоводство* (Agriculture and Sylviculture), Vol. CCV. pp. 616-630. Petrograd, April 1916.

*Geographical conditions.* — In Russia there are three distinct regions of arid steppes:

1) The Pontic region around the northern margin of the Black Sea.

2) The Transdon region and that of the northern Caucasus which together form a triangle with apices at Novotcherkassk, Tzarytzin and Mozdok.

3) The Transvolga region also in the form of a triangle with apices at Kamichin, Saratov and Uralsk.

The last two regions are situated on the edge of a vast semi-desert area which surrounds the Caspian Sea and occupies the greater part of

the province of Astrakan or nearly 11 million acres. This province is divided into two almost equal parts by the lower Volga ; the western half occupied almost entirely by the Kalmuks steppe, and the eastern side which forms the Kirghiz steppe. On the western boundary is the Plateau of Ergenia which constitutes the watershed between the basins of the Don and the Volga and separates the Transdon steppe from the Kalmuks. The north of the Kalmuks steppe and the whole of the Transdon steppe (which covers an area of some 5 ½ million acres) are almost completely free from shifting sand. Travelling south through the Kalmuks steppe, patches of loose sand become more frequent and larger till finally they form a continuous surface which also extends up the right bank of the Volga.

To the east of the Volga between the northern boundary of Astrakan and Khanskaia Stavka the soil is only occasionally loose and shifting, but south and east of that district begins a vast sandy tract which gradually merges into a true desert, where there is not a sign of vegetation and where the surface has been blown up into dunes which are continually being remodelled by the wind. This sandy tract of eastern Astrakan extends over about nine and half million acres and makes up 88 per cent of the total desert steppe in the eastern provinces of Russia.

*Geological conditions.* — The whole of Astrakan including Ergenia has a common geological origin, *i. e.* black, compact, impermeable clays of the lower tertiary which hold up the underground water. In the Ergenia area these are covered by oligocene sandstones readily disintegrated and overlaid by clays and loams whose derivation is still obscure and which gradually pass into loess at the surface.

In the main Astrakan plain, which was once the bed of the Aral-Caspian Sea, the changes in sea level have destroyed the sandstones and these have been replaced by a series of deposits which are sandy at the base and clay above. The most important of these sediments is a dark shaly clay which often comes to the surface in ravines and gives rise to agricultural soil. It varies in thickness from 2 ½ to 23 feet, is plastic and heavily charged with mineral salts (gypsum, sulphate of soda and carbonates). Above the clay are two more recent deposits, *i. e.* a thin layer of grey sand covered by an aeolian deposit of yellow sand.

The actual surface of the steppe at present is one vast expanse of loose sands, the products of the disintegration of the very friable uppermost layers. As these layers for the most part only vary in thickness from 2 to 10 inches, they could not possibly supply alone the enormous quantities of sand on the Astrakan plain. The remainder is derived from adjoining depressions in which cyclones sweep with such force that the Caspian clays have been laid bare in places.

The Astrakan sands consist of well rounded grains, yellow in colour owing to the presence of oxides of iron, and very fine (0.1 to 0.2 mm in diameter). The smoothness of the grains gives the sand a very unstable character with no power to resist the force of the wind which piles them up into shifting dunes.

*Meteorological conditions.* — The climatic of Astrakan is continental. Winters are extremely severe and last three months, a minimum temperature of — 30° C being occasionaly reached. Then a very short spring is followed by great summer heat when the thermometer often rises to 40° C. Prevailing winds are from the east and come like a hot blast across the country. The rainfall is very low. At Astrakan it only amounts to 5.72 ins. while the evaporation is 29.3 ins. or five times as great ; there are 121 rainy days per annum with dry intervals which usually last 7 to 10 days except in July and August when there may be 50 or more consecutive dry days, and on the edge of the Kirghiz steppe drought lasting 130 days has been recorded. In Ergenia the rainfall is higher, 4,5 to 9.5 ins. per annum. Mean temperatures in the desert region (Astrakan) and in Ergenia (Tzaritzin) are as follows :

| | Astrakan C | Tzaritzin C |
|---|---|---|
| Mean temperature for January . . . . . | 7,2 | 11.3 |
| " " " July . . . . . | 25.5 | 29.6 |
| Mean annual temperature . . . . . | 9.4 | 7.0 |

*Underground water.* — As a result of numerous investigations it has been proved that there are two layers of underground water in Astrakan : a lower one 25 to 30 feet below the surface, heavily charged with salts, and an upper of fresh water close to the surface and found in the regions where the ground is covered with *Artemisia.* A well 13 feet deep and 5 feet wide in such regions will supply enough water for 100 head of cattle throughout the whole summer.

I. *Ecological study of Ergenia.* — A certain amount of planting was carried out in Ergenia about the middle of the last century. In 1913 the Russian Department of Forests wishing to know whether it would be advisable to resume planting operations, instituted an enquiry into the progress of the planted areas. The writer who was put in charge of the enquiry did not limit his observations to the condition of the forests, but at the same time made a thorough study of the entire regional flora in its relationship to soil, to climate and to cultivation. In the present paper he gives a detailed ecological description of the region, using for the purpose not only his own data, but also that collected by other investigators. Afterwards he discusses the agricultural possibilities of the area.

In studying the plant associations the system was followed of giving to each association a descriptive name which indicates the type of flora represented. For instance :

*Poaretum* means a multifloral herbaceous flora in which *Poa pratensis* is dominant.

*Stipetum* (from stipare = to crowd) denotes a typical flora of the virgin steppe forming a close turf and made up chiefly of species like *Stipa* and *Koeleria* and in the cast *Avena desertorum* Less.

*Thymetum* is the flora of the calcareous hills where the aromatic species predominate, more especially *Thymus, Satureja, Hyssopus, Zizyphora, Salvia, Scutellaria, Stachys, Teycrium.*

*Artemisietum* is the flora of the acid steppes with weak alkali soils, the dominant species being *Artemisia maritima* and its numerous varieties, *Artemisia pauciflora* Keller, etc.

*Salsoletum* is the flora of strong alkali soils dominated by *Salsola, Salicornia, Suaeda, Petrosimonia, Brachylepsis, Kalidium, Camphorosma, Tamarix,* etc.

Using this type of nomenclature, the chief plant associations in Russia are:

| Forest trees | Herbaceous plants and mosses |
|---|---|
| Saliceta | Sphagneta |
| (Alneta, populeta) | Carecta |
| (Betuleta, especially in the cast) | Poareta |
| Abiegna | Stipeta |
| Pineta | (Thymeta?) |
| Querceta | Artemisieta |
| (Fageta) | Salsoleta |

On the virgin steppe of the Ergenian Plateau, the dominant plant association is divided into three groups according to the soil: 1) *stipetum latifolium* on the black soil; 2) *stipetum cinereum* on the light brown soils; and 3) *stipetum gramineum* on the dark loams. The last is the most abundant and its flora is given below.

## BOTANICAL COMPOSITION OF THE STIPETUM GRAMINEUM.

### A. — *DOMINANT SPECIES.*

#### I. Woody plants.

*Calophaca wolgarica.* (*Spiraea hypericifolia*).

#### II. Plants with long rhizomes.

| | | |
|---|---|---|
| ***Agropyrum ramosum.*** | ***Carex stenophylla*** C. | *Achillea setacea.* |
| *Ephedra vulgaris.* | *Inula Oculus Christi* C. | *Glycyrrhiza glabra?* |
| (*Acroptilon Pieris?*) | *Ranunculus oxyspermus.* | *Poa setacea.* |
| | | *Potentilla bifurca* C. |

#### III. Plants with short rhizomes.

| | | |
|---|---|---|
| ***Agropyrum cristatum*** C. | *Allium flavescens.* | *Galium verum* V, C. |
| (*Allium lineare*). | (*Bromus erectus*). | *Inula hirta.* |
| ***Linosyris villosa*** C. | (*Helichrysum arenarium* V). | (*Ranunculus polyrhizus?*) |
| ***Pyrethrum achilleifolium*** C. | *Iris pumila* C. | *Valeriana tuberosa.* C. |
| | | *Veronica prostrata.* |

#### IV. Plants with short rhizomes and short internodes.

| | | |
|---|---|---|
| ***Stipa sareptana.*** | ***Koeleria gracilis*** C. | (*Phleum Boehmeri*). |
| | ***Festuca sulcata*** C. | ***Stipa stenophylla*** C. |
| | ***Stipa capillata*** C. | |
| | ***Stipa Lessingiana*** C. | |

V. Plants with tap-roots.

*Achillea leptophylla.*
***Artemisia incana.***
*Artemisia pauciflora.*
*Asperula humifusa.*
*Astragalus albicaulis.*
(*Astragalus physodes*).
(*Astragalus testiculatus* et *A. dolichophyllus*).
*Cachrys odontalgica* (C).
*Dianthus rigidus.*
*D. pallidiflorus.*
*Eriosynaphe longifolia.*
*Terula caspica* C.
***Kochia prostrata*** C.
*Statice incana* C.
*Statice sareptana* et *St. tomentella* VI, C.
*Veronica orientalis.*
*Arenaria graminifolia.*
*A. longifolia* C.
*Astragalus subulatus.*
*Astragalus utriger.*
*Dianthus leptopetalus* C.
*Eryngium campestre* C.
*Euphorbia Gerardiana*, VI, C.
*Helichrysum arenarium.*
*Herniaria incana.*
*Linum austriacum.*
*Marrubium praecox.*
*Potentilla astracanica.*
*Statice tatarica* C.
*Thesium ramosum.*
*Veronica spicata* III.
*Asperula glauca* (III ?)
*Astragalus asper.*
*Centaurea ruthenica*
*Crambe aspera.*
*Dianthus capitatus* C.
*Gypsophila paniculata* C.
*Medicago falcata* C.
*Medicago versicolor.*
*Phlomis pungens* C.
*Salvia memorosa.* (= *S. silvestris*).
*Silene wolgensis.*
*Sisymbrium junceum* C.
(*Taraxacum serotinum*).
*Thymus Marschallianus* C.
*Verbascum phoeniceum* C.
*Veronica austriaca.*

VI. Plants which propagate themselves by secondary roots.

(*Convolvulus lineatus*).
*Jurinea linearifolia* C.
*Artemisia austriaca* C.
*Euphorbia leptocaula* C.
(*Lepidium Draba*).

VII. Bulbous and tuberous plants.

*Allium moschatum.*
(*Colchicum luteum*).
***Tulipa Schrenkii*** C.
*Allium flavum* C.
(*Gagea bulbifera*).
*Ornithogalum brachystachys* C.
*Tulipa Biebersteiniana* II.
(*Allium paniculatum*) C.
*Ornithogalum tenuifolium.*
(*Gagea pusilla ?*).

## B. — *SECONDARY SPECIES.*

VIII. Biennuals.

*Trinia Hoffmanni* and its *hispida* variety.
*Erysimum versicolor.*
*Erysimum canescens*
*Onosma tinctorum*
*Salvia Aethiopis* C.
*Serratula* (*xeranthemoides*) C.
*Carduus uncinatus* C.
(*Carduus hamulosus*).
(*Falcaria Rivini*) C.
*Silene viscosa.*
*Verbascum orientale.*

IX. Winter-spring, annuals.

*a*) Early:

*Ceratocephalus orthoceras* et *C. falcatus.*
*Androsace maxima.*
*Agropyrum prostratum* et *A. orientale.*
*Veronica arvensis* et *V. verna.*
*Androsace elongata* C.
*Holosteum umbellatum.*
***Alyssum minimum*** C.
(*Draba verna ?*) C.
(*Thlaspi perfoliatum ?*)
*Lamium amplexicaule.*

*b*) Late:

(*Chorispora tenella*).
(*Colpodium humile* IV)
*Bromus tectorum.*
*Bromus squarrosus* C.
***Poa bulbosa vivipara*** IV.
*Arenaria serpyllifolia* C.

X. Winter annuals.

| | | |
|---|---|---|
| (*Meniocus linifolius*). | *Echinospermum patulum*. | *Camelina microcarpa*. |
| ***Lepidium perfoliatum*** C. | (*Filago arvensis*) C. | *Crepis tectorum*. |
| (*Gypsophila muralis*) C. | (*Trifolium arvense*) C. | *Echinospermum Lappula*. |
| *Echinospermum strictum*. | *Delphinium Consolida* C. | *Lithospermum arvense*. |
| | | *Sisymbrium Sinapistrum* C. |
| | | (*Sisymbrium Loeselii* et *S. Sophia*) C. |

XI. Spring annuals.

| | | |
|---|---|---|
| ***Ceratocarpus arenarius***. | *Eragrostis minor* C. | (*Chenopodium album ?*) |
| ***Echinopsilon sedoides*** C. | ***Polygonum Bellardi*** C. | (*Polycnemum arvense*) C |
| (*Salsola tamariscina*). | *Atriplex patula*. | |
| (*Passerina annua*). | (*Xeranthemum annuum*). | |

XII. Parasitic phanerogams.

| | |
|---|---|
| *Cuscuta planiflora*. | *Orobanche coerulea*. |

C. — *CRYPTOGAMS*.

XIII. Mosses.

| | |
|---|---|
| *Tortula ruralis*. | *Grimmia*. |

XIV. Algae and lichens.

| | |
|---|---|
| ***Parmella vagans***. | *Nostoc commune*. |
| ***Cetraria aculeata***. | |
| (*Urceolaria scruposa*). | |

XV. Fungi.

Probably the majority belong to the ***Angiocarpineae*** (*Lycoperdon* spp., *Geaster* spp.) and ***Plectobasidineae*** (*Pisolithus herculeum* Fries).

In the above table the species are divided into three phytosocial groups according to their habitat. In the left hand column are placed those species which are more xerophytic than typical plants of the association and which are bordering on the next plant association *i. e. stipetum cinereum*. In an analogous way the species placed in the right hand column are all bordering on the more hydrophytic association *i. e. stipetum latifolium*.

The names of the commonest species are printed in heavy type. Brackets mean that the identification of the species is not very certain. Roman numerals are used to show that the plant they follow occupies an intermediate position between the class in which it is placed and the class indicated by the Roman figures. The letter C is used after the name of a species when ever that species is a characteristic plant of the virgin steppe of Ascagna Nova (Pontic region) which has been studied by J. K. Patzoskiĭ.

The dominant species all consist of perennial plants which occupy the soil in a more or less stable condition, absorb more water and nutrient salts than any other species and are the principal producers of organic matter. The secondary species on the other hand are all plants which flower only once (annuals and bienniels). In the Ergenia *stipetum gramineum* the dominant species are made up of 93 species or 61 per cent of the total number, while secondary species, including parasite plants, are represented by 59 species only.

*The deterioration of Steppes and the means taken to check it.* — Sheep farming is general in the Ergenia region, and the system of grazing is such that it frequently has a deteriorating effect on the flora which tends to become more xerophytic in character and by its gradual modification influences the grazing value and the general productiveness of the virgin steppes. In order to prevent this deterioration and consequent decline of the live stock industry it is absolutely necessary that all grazing areas be given regular periods of rest during which the natural flora will have a chance of recovering from the effects of the grazing. Further, selected plots of the virgin steppes should be fenced round and protected from live stock in order to provide natural seed producing centres for the reconstitution of the surrounding flora. These plots should occur at frequent intervals and include various types of plant associations, *i. e. stipetum gramineum, stipetum subsabulosum, stipetum cinereum, stipetum sabulosum.* It is also recommended that dry farming methods be tried with the idea of introducing a more intensive form of farming.

The creation of artificial forests on the arid steppes is one of the most interesting experiments in applied botany and has important bearings on ecological problems. On the Ergenian plateau woody plants will only prosper in places where the water table is accessible, such as for instance in deep hollows, in ravines, or at the foot of gentle slopes. And such places being very limited in extent, there is no possibility of establishing forestry as a separate industry. All attenpts to do so by the Department of Forests have failed. The cultivation of trees will have to form part of the ordinary farming practice, and small plantations will be the rule. Both fruit and timber may be produced. The most suitable trees have proved to be: *Robina Pseudacacia, Quercus* spp. *Populus* spp., *Pyrus communis, Morus* spp.

II. — *The shifting sands of Astrakan* (1). — Ten million acres of the province of Astrakan are covered with shifting sands which have been formed during the nineteenth century and which are estimated to spread at the rate of 100 000 acres per annum. The principal cause of the rapid transformation of good pasture into barren sand is the bad management of the pastoral population who keep their flocks and herds so long in one place as to result in the complete destruction of the turf. Neither is the condition of affairs very much better where arable farming is practised, for the use of tillage implements helps to loosen the surface, while the cultivators manage to suck the land dry in a few years by a bad system of husbandry, taking one crop after another without manure; then as the crops began to fail, the sand invades the ruined fields and gradually covers considerable areas.

The damage done is enormous, not only in Astrakan, but also in the adjoining provinces and in the whole of southeastern Russia. In 1880 the Government became aware of the inroads of the scourge, but it was

(1) A list of Government publications on the subject is given.

taken to check its progress. During the period 1904-1909, 46000 acres not till the early years of of the present century that active measures were were brought under cultivation and in 1913 a special Government Service was organized to deal with the question. The province of Astrakan was put in charge of a chief forestry officer and divided into six districts in each of which a sub-officer was appointed to superintend the work of reclamation. The seven officers were university men and had a staff of 23 working foresters under their orders. All work was carried out and financed on one of the three following systems:

1) The State to supply all technical advice and the material for seeding or planting, but all the labour to be provided by the landlord. Areas dealt with annually: about 1300 acres.

2) The State to supply technical advice, and to pay half the expenses of the working foresters required to superintend the work, and to make an allowance of 5*d* per day towards the housing and keep of each labourer. The population to provide the men and to pay the other half of the foresters' expenses. Area dealt with annually: 1300 to 2600 acres.

3) The land to be temporarily made over by the landlord to the Ministry of Agriculture. The State to do the planting and to pay 90 per cent of the total expenses, the balance being paid by the Administration of the Kirghiz. Contracts of this kind were begun in 1908 and by 1913 some 1 300 000 acres has been planted.

Every year the forest officers make a report of the work done in their districts as well as recommendations for the further development of the scheme.

*Methods employed for fixing the surface of shifting sands.* — Experiments in Nortern Astrakan have shown that *Salix acutifolia* Wild. can have an excellent binding effect on the surface of sands. Cuttings taken from the tips of the branches are merely placed in a plough furrow. The method is simple and inexpensive, costing about 6*s* per acre and at the end of three or four years not only is the capital expenditure repaid, but the land may have risen in value to the extent of another 6*s* per acre.

In the southern part of the province, where the sandy area is greatest, reclamation is carried eithr by planting cuttings of *Salix acutifolia* and *S. caspica* Pall (1) ("narym-tala") or young plants of *Pterococcus aphyllus* Pall (2) ("djuzgun") and *Calligonum* spp. (3) ("Kandym") or by use of herbaceous crops, The latter is the more common method, as planting is comparatively expensive (£ 3 to £ 5 per acre), and require besides some sort of protection from the wind, such as parallel wind screens about 9 ins. high and 13 ft. apart costing £ 1 10*s* to £ 3 per acre. Plantations too, require after cultivations in the form of hoeings and weedings. Herbaceous plants on the other hand are not only less costly to grow, but

(1) According to VISOTZKI, in *Bulletin of Applied Botany* No. 10-11, 1915, p. 1240.

(2) Cf. *Agricultural Encyclopaedia*, Vol. IX. p. 482. Petrograd 1905. Publishers, A. E. DEVRIEN.

(3) Cf. *Id.* Vol. X, p. 143. Petrograd 1907.

cover the surface with crops which are of great and immediate value to the population.

Where the conformation of the land will allow it, surface vegetation will gradually appear if the soil is left quite undisturbed. *Elymus arenarius* and *Agriophyllum arenarium* are the first to establish themselves and their roots rapidly spread over the surface and down into the sand to a depth of even 5 or 6 yeards. Later other species appear, gradually covering the surface and protecting the sand from the action of the wind.Then finally the two first comers disappear and their places are taken by *Artemisia maritima* which provides excellent sheep pasture. But to complete this process, 20 or 30 years are required and it is generally more satisfactory to hasten matters by artificial methods, at least on some parts of the area, so that centres for seed distribution may be formed and help in the natural reclamation of the land. Usually the procedure is as follows : a survey is made of the area, to pick out places which are sheltered from the wind, such as the hollows of the dunes. Seed of *Elymus arenarius* and *Agriophyllum arenarium* is then sown in patches of about one square yard on these selected spots and at the rate of 3 to 6 lbs. of each per acre. The crests and flanks of the dunes, where seedlings would at once be destroyed, are not touched.

All seeds are supplied from Government seed stations of which 10 are already established and occupy 35 acres of land. Cuttings and young woody plants are also raised in Government nurseries. Those in the north of the province grow pines, birches, oaks, black poplar, etc.,while those in the south produce robinia, apricots, *Pterococcus aphyllus* and *Calligonum* spp., the total area under nurseries being 150 acres.

Replanting is only just in its initial stages. In 9 years not more than 45 acres have been planted besides 3 gardens and 4 vineyards occupying about 11 acres. The real obstacle to progress in this direction is the uncertainty as to whether the greater part of the province of Astrakan is adapted to the establishment of forests ; but with the institution of the special State Service referred to above, the question will receive proper attention and in the event of a favourable report, planting will proceed more vigorously.

MANURES AND MANURING

1165 – **Research on Superphosphates.** — PRATOLONGO U., (Agricultural High School, Milan) in *Annali d. Chimica applicata*, Vol. VI, Nos. 3 and 4, pp. 59-112. Rome, 1916.

The mechanical condition of superphosphates is a most important factor in estimating their value, as unless the manure be dry and in a very fine state of division it is impossible to spread it evenly on the land. In order to determine how the friability and dryness are affected by the conditions of its manufacture investigations were made on the constitution of the substance in the various stages of the process. The results are summarised as follows :

1) Superphosphate contains three chief constituents, calcium sulphate, mono-and dicalcium phosphate, which are found in a more or less hydrated condition and under various crysralline forms. Calcium sul-

phate may be present either as the anhydrous salt or as gypsum. In ordinary superphosphates the former predominates, usually almost exclusively ; where however the superphosphate has been prepared from bones and with limited quantities of sulphuric acid, the calcium sulphate is then nearly all in the form of gypsum. Monocalcium phosphate is commonly $CaH_4 (PO_4)_2 H_2 O$, but the anhydrous salt is not rare and has a very definite effect on the character of the manure. The same applies to dicalcium phosphate.

2) Superphosphate also contains a certain amount of moisture, its so-called " liquid phase " which consists essentially of a solution of phosphoric acid and phosphate of lime, and which largely controls the mechanical condition of the manure.

3) The investigations in this connection have made it possible to define exactly what is meant by " true moisture " and " free phosphoric acid ", terms which have been used somewhat loosely up to the present. An examination of the relationship between the chemical and physical properties of the superphosphate have shown that the state of division is intimately connected with the measure of its liquid phase and still more directly with its true moisture, or in other words, with the water present in a liquid form as distinct from water of crystallisation. Further the degree of fineness of the superphosphate also varies with the amount of free phosphoric acid in the fertilizer. Two methods are suggested for the determination of true moisture, both being based on the solubility of the free water in cold alchohol. This alchohol extract may also be used for estimating free phosphoric acid.

4) The investigation in to the conditions of the manufacturing proces as affecting the constitution of the product has shown that the state of hydration in which mono-and dicalcium phosphate are deposited and the content of free phosphoric acid in the fertilizer are regulated by the temperature curve of the reaction and by the dilution of the sulphuric acid employed. Both free phosphoric acid and true moisture (taken as the difference between total moisture and that retained as water of crystallisation) increase with the temperature. Other conditions being equal the free phosphoric acid content also varies with the strength of the sulphuric used.

5) In the industrial process, calcium sulphate is first deposited in the anhydrous form or rarely in the semi-hydrated form ($2 CaS_4 OH_2 O$) ; gypsum, when present, may be looked upon as a secondary product resulting from the hydration of the two above compounds. Mono and dicalcium phosphates on the other hand are deposited as anhydrous or hydrated salts according to the temperature and composition of the liquid in which they are formed, and these two related factors govern the mechanical condition of the resulting superphosphate..

Once the relationship has been established between the temperature curve of the reaction and the properties of the substance produced, it is easy to organize means of regulating the process by adjusting the heat of the reagents, the quantity of acid used, the degree of fineness to which

the raw phosphate is ground, the size of the charge put into the mixer and the duration of the mixing, the aeration of the reaction chamber. With proper adjustment it is possible to convert the whole of the raw phosphate into soluble phosphate and to obtain in the finished product a very fine state of division.

In a general way the temperature of the mixture is kept between 60° and 100° C. Outside these limits, which vary slightly with the acidity, a perceptible increase of the liquid phase is brought about which exercises a marked influence not only on the state of subdivision of the immediate product, but also on its successive transformation. This may even confer definite hygroscopic properties to the mass and may completely prevent the secondary formation of gypsum at the expense of anhydrite which is a change conferring on the ultimate product a high degree of dryness and fine subdivision.

The experiments confirm the results of practical experience in manure works, *i. e.* that in order to obtain a fine dry superphosphate the temperature in the mixer should not exceed 100° C.

1166 – **Substitutes for Basic Slag in Italy.** — Menozzi A., in *Le Stazioni sperimentali agrarie italiane*, Vol. XLIX, No. 1, pp. 7-9. Modena, 1916.

Before the war, the annual consumption of basic slag in Italy surpassed 30 000 tons, the greater part of which came from abroad. Since August 1914, however, imports have almost ceased. Basic slag has always been recommended in preference to superphosphate on soils poor in lime and rich in organic matter, but on many such soils superphosphate has given excellent results. Pratolongo has recently shown by his work at the Milan Agricultural High School that such soils have a considerable power of absorption for phosphoric acid in the form monocalcium phosphate, *i. e.* in the form present in superphosphate. He showed further: 1) that the phosphoric acid is very rapidly absorbed by hydrates of iron and aluminion so that there is no chance of its being washed away; and 2) that superphosphate, though an acid manure, can be added to the soils containing no lime without giving the soil an acid reaction. It is therefore evident that applications of superphosphate on non-calcareous land are not always followed by the ill-effects one might fear.

It is only when dealing with bogs or sour peats that superphosphate is really unsuitable and in these cases either bone meal may be used, or basic superphosphate which has been on the Italian market for some time and whose output could easily be increased should the demand for it arise.

1167 – **Iodine Content of Stassfurt Salts.** — Winkler L. W. in *Zeitschrift für angewandte Chemie*, Year XXIX, No. 71, pp. 342-343. Leipzig, September 5, 1916.

Hitherto determinations of iodine in Stassfurt salts have given discordant results. A series of very accurate analyses were therefore carried out on carnallite and sylvine. The method employed is fully described. Quantities of iodine found in the two minerals were as follows:

| | | mgms. of iodine per 1000 gms. of substance |
|---|---|---|
| *Sylvine* | colourless, crystalline | 0.0 |
| " | hyaline crystals | 0.0 |
| " | colourless crystals | 23.7 |
| " | crystalline light yellowish red. | 13.7 |
| " | " yellowish red | 73.1 |
| " | colourless crystals. | 0.0 |
| *Carnallite* | crystalline yellowish | 5.0 |
| " | " grey | 4.5 |
| " | " red | 0.0 |
| " | " pink | 0.0 |
| " | colourless crystals | 0.0 |

None of the samples analysed contained potassium iodate. In sylvine, the iodine was present as potassium iodine and in carnallite it was probably in the form of $KI.Mg.I_2.6H_2O$. Crude bromine was also tested for iodine, with negative results.

1168 – **Effect of Varying Amounts of Admixed Water upon the Decomposition of Crude Calcium Cyanamide and the Formation of Dicyanamide.** — HAGER G., and KERN J., in *Zeitschrift für angewandte Chemie*, Vol. XXIX, pp. 221-223, 1916; abstract in *Journal of the Society of Chemical Irdustry*, Vol. XXXV, No. 15, pp. 856-857. London, August 25, 1916.

Quantities of crude calcium cyanamide of 100 gms. each were treated separately with 5, 10, 15, 25, and 50 gms. of water and enclosed in air-tight glass vessels. After 5 or 7 months the material was analysed by CARO' s method. The fertiliser used contained: total nitrogen 18.62 per cent, of which 17.73 was water soluble, cyanamide nitrogen 16.75 per cent, nitrogen as dicyanamide 0.50 per cent, as ammonia 0.24 per cent, and as "urea" nitrogen (*i. e.* the element left in the filtrate after precipitation of the dicyanamide) 0.48 per cent.

Seven months storage without water caused no perceptible change: with 5 and 10 gms. of water, the changes were very small, the dicyanamide nitrogen rising to 0.61 and 0.87 per cent respectively. The presence of 15 gms of water produced more change: the dicyanamide nitrogen rose to 1.13 per cent, the urea nitrogen to 0.71 per cent the cyanamide nitrogen fell to 13.61 per cent, and the ammonia nitrogen to 0.14 per cent. Very little change took place in the first ten days when 25 gms. of water was added but after 7 months, 2.58 per cent of dicyanamide was found. With 50 gms. of water profound changes took place and the material set to a hard stone like mass; after 2 ½ months and 7 months, the dicyanamide nitrogen rose to 7.51 and 9.17 per cent respectively, the cyanamide nitrogen falling to 2.81 and 0.28 per cent respectively in the same periods. Calcium cynamide should not be stored after it has become wet but it may be used immediately; the use of water to produce it in a granulated form is not likely to succeed.

1169 – **Manurial Experiments with Manganese Slag in Germany** — Popp M., in *Fühlings Landwirtschaftliche Zeitung*, Vol. 65, Nos. 15 and 16, pp. 354-360. Stuttgart, August 1 and 15, 1916.

Manganese slag is obtained in large quantities in Germany as a bye-product in the manufacture of ferromanganese and spiegleisen. Its average chemical composition is given below :

| | per cent | | per cent |
|---|---|---|---|
| Manganese | 24.4 | Magnesia | 6.3 |
| Silicic acid | 30.5 | Sulphur | 1.2 |
| Alumina | 9,8 | Iron | traces |
| Lime | 33.4 | | |

The manganese is insoluble in water, but slowly soluble in weak acids. Its percentage occasionally rises to 30.

A series of pot experiments were carried out in which the manurial value of the manganese slag was compared with that of anhydrous manganese sulphate. The slag was used in a powdered form similar in fineness to basic slag. It contained 18 per cent of manganese and 32.26 per cent of silicic acid, and was applied to sandy soil made up of :

| | per cent | | per cent |
|---|---|---|---|
| Gravel | 5.85 | Lime | 0.28 |
| Coarse sand | 15.10 | Phosphoric acid | 0.14 |
| Fine sand | 49.75 | Potash | 0.13 |
| Clay | 29.30 | Nitrogen | 0.15 |

Each pot contained 10 kgs of soil and received 1 gm. phosphoric acid, 1,5 gm. potash, 1,5 gm. nitrogen and 60 gms. of calcium carbonate in the form of marl, besides dressings ranging fro 0.5 to 10 gms. of manganese either as sulphate or as slag. White Petkus oats were sown on April 17 and harvested July 17. Manganese slag increased the yield of both grain and straw in proportion to the amount applied except where the maximum dressing was used. In small amounts (0.5 and 1 gm) manganese sulphate was more effective than slag, but with the larger applications (2.5 and 5 gms). the order was reversed. Taking the maximum increase in yield as 100, the results of the experiments are as follows :

| Amount of manganese applied | Increase in yield due to manganese | |
|---|---|---|
| | Slag | Sulphate |
| gms. | — | — |
| 0.5 | 13 | 33 |
| 1.0 | 44 | 52 |
| 2.5 | 69 | 62 |
| 5.0 | 90 | 57 |
| 7.5 | 100 | — |
| 10.0 | 91 | — |

With manganese slag the grain was affected more than the straw ; with manganese sulphate the reverse was the case. Increase in yield due

to slag varied in the first place with the size of the dressing and the solubility of the manganese, and to a less extent, with the nature of the soil and its manganese content.

Further experiments are recommended in order to decide whether heavy dressings of manganese slag may be employed with profit by farmers.

AGRICULTURAL BOTANY. CHEMISTRY AND PHYSIOLOGY OF PLANTS

1170 - **Comparative Study of the Root Systems and Leaf Areas of Corn and the Sorghums.** — MILLER E. C., in *Journal of Agricultural Research*, Vol. VI, No. 9, pp. 311-331. Washington, May 29th 1916.

During the summers of 1914 and 1915 a series of investigations was conducted to determine the fundamental characteristics possessed by the sorghum plants (*Andropogon sorghum*) which enable them to withstand severe climatic conditions better than the corn plant (*Zea Mays*). The present paper deals with the comparative study of the root systems and leaf areas of corn and of the sorghums Blackhull Kafir and Dwarf Milo. These experiments were carried on at the State Branch Experiment Station at Garden City, Kansas, in latitude 37° 58′ north and longitude 100° 55′ west (Greenwich) and at an altitude of 2940 feet.

The root systems of Pride of Saline corn, Blackhull Kafir and Dwarf Milo sorghum plants which were grown in alternate rows, were isolated in the field at four stages of growth in 1914 and at three stages of growth in 1915. All told, the root systems of 33 plants were isolated and studied. It was found that for a given stage of growth each plant possessed the same number of primary roots and that the general extent of these roots in both a horizontal and vertical direction was the same for all three plants. The maximum depth of root penetration for mature Dwarf Milo, Blackhull Kafir, and corn was found to be 6 feet for both the years 1914 and 1915. Blackhull Kafir and Dwarf Milo possessed approximately twice as many secondary roots per unit of primary root as did the corn plant. This is true not only for both years but also for all stages of the root systems examined. Both primary and secondary roots of the sorghums were found to be more fibrous than those of the corn plant.

The relation of the weight of the dry matter of the aerial portions of mature plants to the weight of the roots was determined in 1914 for 36 Dwarf Milo plants, 30 Blackhull Kafir plants and 12 corn plants. In 1915 the same determinations were made for 24 Dwarf Milo, 14 Dwarf Blackhull Kafir, 23 Blackhull Kafir and 24 corn plants.

The average ratio of the dry weight of the grain, stem and leaves of standard Kafir to the dry weight of the roots was found to be 15 and 14.9 for the years 1914 and 1915 respectively, while the dry weight of the stem and leaves of the same plant was on the average 10.9 times that of the root weight in 1914 and 10.1 times the root weight in 1915. For Dwarf Milo the corresponding figures were 15.7 and 15; 9.6 and 8 respectively. For corn the weight of the stem and leaves was 9.6 times the root weight in 1914 and 7,8 times in 1915. For Dwarf Blackhull Kafir in 1915 the figures were 15.7 with the grain and 8.9 without the grain.

The results of the experiments in regard to the soil-moisture content and depth of root penetration seem to show that under the conditions of the

experiment very little, if any, depletion of soil moisture took place below the depth of root penetration.

The average leaf areas of five representative plants of corn Blackhull Kafir and Dwarf Milo were obtained at stages when the plants were 4, 6, 8 and 10 weeks of age. The last stage examined showed that the plants had completed their full leaf development. In all the stages of growth the corn plant was found to have the greatest leaf area. Taking the stages of growth in order, the leaf area of the corn plant was 1.7, 2.0, 2.2 and 2.3 times the leaf area of Dwarf Milo and 1.6, 1.9, 1.5 and 1.5 times of that Blackhull Kafir.

From the experimental results it is apparent that the Dwarf Milo and Blackhull Kafir plants would have the advantage over the corn plant under any climatic conditions that would tend to bring about a loss of water from these plants. The two sorghums have, in the first place, as compared to the corn plant, only one-half the leaf surface exposed for the evaporation of water ; and in the second place they have a root system which, judging from the number of secondary roots, would be twice as efficient in the absorption of water from the soil.

1171 – **Barium in Tobacco and Other Plants.** — ARTIS B., and MAXWELL H. L., in *Chemical News*, Vol. 114, No. 2959, pp. 62-63. London, August 11th 1916.

Other workers (1) have found barium in various plants and, as this element is widely distributed in soils, the question has arisen as to whether it is really a plant food, although it has not been found in all the species analysed. The writers of this article have examined the leaves and stems of tobacco grown in various places and also the leaves of several other plants, some of which were grown on soils containg 0.1312 per cent of barium sulphate. The chief results are summed up in the appended Table.

TABLE I. — *Proportion of barium in tobacco grown in different places.*

| Kinds of tobacco and districts where grown. | Leaves | | Stems | |
|---|---|---|---|---|
| | Ash | Barium sulphate | Ash | Barium sulphate |
| | per cent | per cent | per cent | per cent |
| Havana tobacco from Cuba . . . . . | 20.85 | 0,0608 | 25.68 | 0.0760 |
| Broad leaf, grown in Pennsylvania . . . . | 21.98 | 0.0648 | 21.62 | 0.0780 |
| Havana seed grown in Connecticut . . . . | 20.11 | 0.0600 | 19.38 | 0.0720 |
| Pennsylvania tobacco, grown in Pennsylvania | 21.48 | 0.0980 | 24.28 | 0.1280 |
| Sumatra tobacco . . . . . | 20.87 | 0.0308 | 24.73 | 0.0408 |
| Winconsin tobacco, grown in Wisconsin . . | 21.62 | 0.0192 | 24.49 | 0.0280 |
| Tobacco grown in New York State . . . . | — | 0.0132 | — | 0.5040 |

(1) See *B.* August 1913, No. 924. (*Ed.*)

TABLE II. — *Proportion of barium in the leaves of various plants.*

| Species | Time of cutting | Barium sulphate |
|---|---|---|
| | | per cent |
| Dogwood | autumn | 0.0224 |
| Cotton wood | autumn | 0.0052 |
| | spring | 0.0528 |
| Cherry | autumn | 0.0392 |
| | spring | 0.0134 |
| Black locust | autumn | 0.0324 |
| Mulberry | autumn | 0.0696 |
| Elm | autumn | 0.0356 |
| | spring | 0.0182 |
| Linden | autumn | 0.0152 |
| Wild olive | autumn | 0.0048 |
| Plum | autumn | 0.0372 |
| Box elder | autumn | 0.0360 |
| | spring | 0.0295 |
| Hard maple | autumn | 0.0368 |
| Walnut | autumn | 0.0752 |
| Pear | autumn | 0.0196 |
| Soft maple | spring | 0.0273 |
| Wild grape | spring | 0.0941 |
| Wild cherry | spring | 0.0336 |
| Lime | spring | 0.0435 |
| Elderberry | spring | 0.0143 |
| Black walnut | spring | 0.0096 |
| Sumac | spring | 0.0071 |
| Blackberry | spring | 0.0086 |

1172 – **Cereal Selection in Croatia, Austria Hungary.** — MANDEKIC V., in *Zeitchrift für Pflanzenzüchtung*, Vol. II, Part. 2, pp. 161-192. Berlin, June 1916. PLANT BREEDING

*Wheat.* — The selection of wheat was first carried out at Krizevci Agricultural High School, and dealt with indigenous and foreign varieties, the former proving to be the less productive. Among foreign varieties Sirban Prolific has given the best results up to the present. Its pedigree is unknown, but probably it is derived from a spring wheat. During five years experiments Sirban Prolific has given consistently higher yields than the wheats Banat, Früher Bastard, Renodlad, Golden Perle, Extra Squarehead, Imperial, and the best indigenous varieties. It has however the disadvantage that it cannot stand the winter cold. In 1911-1912 some hundreds of ears of Sirban Prolific were selected and the seeds were sown the following year. The best lines that were thus obtained were Red Sirban Prolific, White Sirban Prolific, Rust-resisting Red Sirban Prolific, Sirban Prolific with dark grey ears, Grey bearded Sirban Prolific.

As soon as the value of this variety was recognised, attempts were made to cultivate it in other parts of the country with satisfactory results.

In Croatia it is now grown on about 287 500 acres per annum, and much seed is exported to Dalmatia, Istria, Carinthia, Bosnia and Herzogovinia, where it is much appreciated. The selected lines mentioned above are not yet in the market, except one which is already well adapted to the needs of the country.

Selection at Krizevci is specially directed towards obtaining lines which are proof against lodging, rust, and winter cold. Wheat selection is also carried out in Croatia at the Plant Breeding Station on the Vukovar estate (recently founded by Count Eltz) and at the Ruma Station on the Pejacsevich estate.

*Rye.* — Foreign varieties of rye are less suited to the conditions obtaining in Croatia. The best results are obtained with indigenous varieties, especially with Potocec rye, which is very robust, possesses good straw, does not lodge, tillers well and has a long ear with long awns. The quality of the grain is good, with an average yield.

The aim of the work at Krizevci has been to obtain an early rye giving a good crop, but resistant to winter cold and to diseases. The method adopted is that of pedigree culture. Some good strains have already been secured, but they have only recently been distributed to the growers. It is hoped that by this means the rye production of the country will be considerably increased.

*Barley.* — Indigenous varieties are chiefly grown in Croatia, as foreign sorts are less resistant to rust. The former are early, not very susceptible to rust, and are of good quality, but their yield is not very high. All the winter sorts need to be sown early in order that the plants may make good root growth in the autumn. Those that have been selected are of good quality but the straw is weak so that they lodge easily.

With spring sown barley the best results have been obtained with foreign varieties. A 2-rowed barley derived from the original Kwassitzer Hanna by mass selection is particularly good. Since 1913, individual selection has been carried out. The aim has been to obtain a very early variety with a fairly stout straw, which tillers well and produces a long ear with uniform grains of low nitrogen content, furnished with thin glumes.

*Oats.* — Experiments have shown foreign varieties are much more productive than the native kinds. One of the best is Duppau which was imported from Hungary, but, in wet seasons it is badly attacked by rust. The best kinds are those with thin leaves, e. g. Heine, which has been submitted to individual selection since 1912.

*Maize.* — The first maize to be selected was an indigenous variety, Round Croatian, which has been grown for some years in the experimental plots at Krizevci. In addition Pignoletto, American Horse-tooth and a very early variety Hangarii, derived form the high plateau of Bosnia, have been selected in order to obtain strains possessing ears with numerous straight rows of grains with much horny starch. In addition to this attention has been paid to the self-fertilisation and cross fertilisation of maize.

1173 - **Agricultural Value of Impermeable Seeds.** — HARRINGTON, G. T., in *Journal of Agricultural Research.*, Vol VI., No. 20, pp. 761-796. Washington D. C., August 14, 1916. AGRICULTURAL SEEDS

During the years 1909 to 1916 many germination tests of the seeds of clover, lucerne, winter vetch, okra (*Hibiscus esculentus* L.) and other plants were made for the purpose of determining the agricultural value of the impermeable seeds.

Impermeable seeds are those whose coats are impermeable to water at temperature favourable to germination. Such seeds have been described by numerous investigators under the term " hard seeds " ; the more appropriate term " impermeable seeds " was introduced by GUPPY and is used in the present paper.

Some plants, cultivated or wild, produce both impermeable and permeable seeds ; the percentage of impermeable seeds has been determined for some of these species, as follows :

*Percentage of impermeable seeds in some cultivated plants.*

| | per cent |
|---|---|
| *Trifolium pratense* L. | 9.61 |
| *T. hybridum* L. | 10.16 |
| *T. repens* L. | 17.30 |
| *Melilotus alba* Desv. | 42.39 |
| *Medicago sativa* L. | 13.81 |
| *Vicia villosa* Roth | 20.97 |
| *Vicia sativa* L. | 0.96 |
| *Vigna sinensis* (Torner) Savi | 3.55 |
| *Medicago hispida denticulata* (Willd) Urban | 48.08 |
| *Medicago arabica* L. | 71.67 |
| *Medicago sativa falcata* (L) Döll | 49.72 |
| *Medicago lupulina* L. | 10.45 |

Most of the work reported in this paper was done with the seeds of red clover, alsike clover, white clover, white sweet clover, alfalfa, hairy vetch (*Vicia villosa* Roth) and okra. Some work was also done with crimson clover (*Trifolium incarnatum* L), black locust (*Robinia pseudacacia* L), kidney bean (*Phaseolus vulgaris* L), pea (*Pisum sativum* L), cowpea (*Vigna sinensis* Sair) and *Chamaecrista nicitans* L. Muench.

The following conclusions were reached : It is impossible to distinguish between impermeable and permeable seeds except by testing their ability to absorb water at a temperature favourable for germination. The production of impermeable seeds is particularly characteristic of the Leguminosae, but it occurs also in many other plant families. Among the cultivated species which sometimes produce impermeable seeds are okra, hollyhock (*Althaea rosea* [L] Cav.), *Erodium cicutarium* [L] l'Her., *Atriplex* spp., asparagus, morning glory (*Ipomaea purpurea* [L] Lam), canna (*Canna indica* L.), cherry tomato (*Physalis pubescens* L.) and nearly all the cultivated species of Leguminosae.

Impermeable seeds frequently retain their vitality for many years, sometimes for at least as many as 80 years. Fresh impermeable seeds

germinate promptly when the seed coat is broken or becomes permeable. The viability of fresh impermeable seeds is frequently greater than that of fresh seeds of the same species which are permeable. Seeds of the common clover, alfalfa and hairy vetch which are impermeable at the end of three to five years under laboratory conditions of storage retain their vitality apparently unimpaired up to that time. The viability of the permeable seeds in the same lots decreases slightly in the second and third year and more in subsequent years.

In dry storage nearly all impermeable alsike clover, white clover and sweet clover seeds remain impermeable until at least 2 or 3 years old. Impermeable red clover seeds become permeable gradually in dry storage, but from one third to two thirds of them may still be impermeable after four years. Okra seeds become less permeable as their age increases.

In wet blotting paper nearly all impermeable lucerne, crimson clover, hairy vetch and okra seeds soften and germinate in one year, though a very few may remain impermeable even after three or four years. Impermeable seeds of red clover, alsike clover, white clover and sweet clover soften and germinate more slowly, but with no uniformity as to rate. All germinate within one year in some cases, while in other cases, over 50 per cent are still impermeable after four years.

Impermeable clover seeds which were thoroughly matured before harvesting soften and germinate more slowly under conditions favourable for germination than do impermeable seeds of the same species which were less well matured ; they also become permeable more slowly in dry storage. Impermeable seeds become permeable more rapidly in wet blotter than in dry storage.

It is impossible to estimate even approximately in advance the proportion of the impermeable seeds in any given lot which will germinate in any given length of time under ordinary germination conditions. A widely variable proportion of the impermeable seeds of lucerne, crimson clover and the larger seeded commercial species included in the investigation produce seedlings promptly in the soil under greenhouse conditions or in the open field in warm weather. Only in exceptional cases is this true of the impermeable seed of the clovers, other than crimson clover.

The use of aqueous extract from soil has no effect, and alternate wetting and drying of the seeds has but little effect on the germination of impermeable seeds.

Within ordinary limits, neither the depth of planting nor the firmness of the soil affects the germination of impermeable clover and lucerne seed under greenhouse conditions. These factors may affect the stand secured by preventing some of the seedlings from reaching the surface.

Storing impermeable clover and lucerne seeds at a temperature of 122° F. for one day or 113° for six months has little or no effect upon their germinating capacity or permeability.

In wet blotting paper a temperature of 107° F. very slightly increases the softening of the impermeable seeds, but it also kills some of the seeds

Freezing when wet causes the subsequent germination of many impermeable seeds, but may kill some seeds which had previously softened. Any constant temperature from 34° F. has little effect upon the softening of impermeable clover seeds. Alternations of temperature have but little effect on the softening and germination of impermeable clover and alfalfa seeds if none of the temperatures used in the alternations are below 68° F.

Alternations of temperature cause the softening and germination of many impermeable clover seeds when a temperature of 50° F or cooler is used in alternation with a temperature of 68° F or warmer. The effect of such an alternation of temperatures is greatly increased by previously exposing the seeds to germination conditions at a cool temperature (50° F. or cooler), and is decreased by previously exposing the seeds to germination conditions at a warm temperature (86° F.)

Even under the most favourable conditions only a small proportion of impermeable red clover, alsike clover, white clover and white sweet clover seeds produce seedlings promptly when sown in warm weather.

Impermeable seeds of red clover, alsike clover, white clover and white sweet clover will pass the winter in the soil in a freezing climate without injury. A least 50 or 60 per cent of them may be expected to germinate in the soil the following spring unless some of them germinate during warm weather in the winter. If this occurs, the seedlings produced in the winter are liable to be killed by subsequent freezing.

A large proportion of impermeable lucerne, crimson clover, okra and hairy vetch seeds will germinate in the soil during the first few months after planting, some of them early enough to be of importance to the crop. Nearly all lucerne and okra seeds, even if they are impermeable in the autumn, are killed when they pass the winter in the soil or on the plants out of doors in a freezing climate. A small proportion of the impermeable lucerne seeds survive with their vitality uninjured. Some of the okra seed remain impermeable during the winter, but the majority even of those which remain impermeable are killed by the winter's exposure.

The following general rules, based upon the above conclusions and the experimental results, are suggested as guides in agricultural practice with impermeable seeds :

a) *When seed is to be sown in the late spring or summer.*

Consider one tenth of the impermeable seed as good. Add one tenth of the percentage of impermeable seed to the percentage of germination. Calculate from this sum the quantity of seed of the given lot necessary to give the desired quantity of good germinable seed. This may be expressed in the form of an equation, thus :

$$\text{Number of lbs. to sow per acre} = \frac{\text{Number of lbs. of good seed desired per acre}}{\text{Percentage of germination} + {}^{1}/_{10} \text{ percentage of impermeable seeds}}$$

For example, suppose it is desired to sow per acre 15 lbs. of viable seed, none of which is impermeable. Fifty per cent of the lot of seed to be used germinates and forty per cent is

impermeable. Considering one tenth of the latter, or 4 per cent, as good, then the amount of seed required per acre would be

$$\frac{15}{0.50 + \frac{0.40}{10}} = 27.8 \text{ lbs.}$$

The impermeable seeds remaining in the soil during the winter will help to improve any thin areas in the stand the following spring, but this, however, should not be counted upon.

b) *seeding in the late autumn or winter or in the spring a month or so before the end of freezing weather*:

Consider all the impermeable seeds as good. Add the percentage of impermeable seeds to the percentage of germination. Using the figures as in the preceding case (*a*) the quantity of seed to use would be

$$\frac{15}{0.50 + 0.40} = 16.7 \text{ lbs.}$$

c) *When seeding in the spring after danger of severe frost is past, but a month or more before the end of cool weather*:

The general formula is

$$\text{Number of lbs. to sow per acre} = \frac{\text{Number of lbs. of good seed desired per acre}}{\text{Percentage of germination} + {}^{2}/_{3} \text{ of impermeable seeds.}}$$

With the same figures as before the quantity of seed required would be

$$\frac{15}{0.50 + {}^{2}/_{3}\,(0.40)} = \frac{15}{0.50 + 0.26} = 19.7 \text{ lbs.}$$

2. Lucerne and crimson clover.

The formula is again

$$\text{Number of lbs. to sow per acre} = \frac{\text{Number of lbs. of good seed desired per acre}}{\text{Percentage of germination} + {}^{2}/_{3} \text{ percentage of impermeable seeds.}}$$

More than two-thirds of the impermeable seeds may germinate, but the excess should not be reckoned on.

3. Hairy Vetch.

$$\text{Number of lbs. to sow per acre} = \frac{\text{Number of lbs. of good seed desired per acre}}{\text{Percentage of germination} + {}^{1}/_{2} \text{ percentage of impermeable seed.}}$$

4. Okra.

$$\text{Number of lbs. to sow per acre} = \frac{\text{Number of lbs. of good seed desired per acre}}{\text{Percentage of germination} + {}^{1}/_{4} \text{ percentage of impermeable seeds.}}$$

More than one fourth of the impermeable seed will probably germinate but too late to contribute to a uniform stand.

1174 – **The Seed of *Commelina communis* L. Characteristic of Seed Samples derived from the Maritime Region of Eastern Siberia.** — Исаченко Б. Л. (Issatchenko B. L.), *Записки Станціи для испытанія сѣмянъ при Императорскомъ Ботаническомъ Садѣ Петра Великаго въ Петроградѣ* (*Annals of the Seed Control Station at the Imperial Garden of Peter the Great at Petrograd*), Vol. III, Part 5, pp. 3-27. Pétrograd, 1916.

As an auxiliary means of determining the place of origin of crop seeds recourse may be had to the identification of the weed seeds which occur mixed in the samples. This method demands numerous analyses of

samples of seeds of cultivated plants and a complete botanical analysis of the weed seeds in order to be certain which of the latter may be considered as characteristic of a given district.

The investigations here described were made on seed samples from the maritime region of eastern Siberia, and were supplied to the seed control station by the Department of Agriculture. The samples were taken during the winter of 1910-1911, and they all belonged to the 1910 harvest. They were representative of the condition in which the farmers send the grain to the market or mill; this material obtained direct from the the producers was exceedingly valuable for the botanical analysis of weed seeds.

The district was divided into seven zones according to the methods of cultivation adopted, and the results were grouped to correspond. This division, however, has no direct bearing on the problem in hand, and it has only been used in drawing up the tables for the benefit of those who desire to study the farm seeds used in the district.

Seed samples of cereals (wheat, rye, oats, barley), buckwheat and flax were examined. It appears that *Commelina communis* L. family Commelinaceae Reich. is widely distributed in the district. In view of the fact that this plant is completely absent in samples of cereals derived from western Siberia, which have been analysed at this Station, it is considered that the presence of seeds of *Commelina communis* L. may, be taken as an indication that the samples come from eastern Siberia, probably from the maritime region.

In 1913 and 1915 *Commelina communis* seeds from the 1910 harvest were sown in the Imperial Botanic Garden of Peter the Great, at Pétrograd, and they grew well in every case. This shows that the seeds retain their germinating capaciy for a long time (it was still about 55 per cent at the end of six years and that the plant will grow in the west.

*Commelina communis* seeds are earth colour and resemble bits of earth in shape. The dimensions are : length, 2 to 4 m.m, breadth 1.5 to 2.9 m.m ; on the average, the length is 2.7 m.m., breadth 2.3 mm. The weight of 1 000 seeds averages 7.9 gms. and the weight of a single seed varies from 0.005 to 0.011 gm.

In Manchuria the colouring matter of the petals of *Commelina communis* is used to dye cotton thread blue.

Among the harmful weed seeds found in the samples analysed, attention was attracted to those of *Agrostemma Githago*, which were much larger and heavier than the seeds of the same plant derived from certaiu localities of Russia in Europe (1). In this connection the following data may be given.

*Avena fatua* was also found. This has hitherto been regarded as unknown in the district under consideration but these experiments indicate that it must have been imported with cereal seeds ; it is now well established even in the extreme East.

(1) See *R.* September 1916. No. 968. (*Ed.*).

*Figures relating to seeds of Agrostemma Githago from different places.*

| Locality | Weight of 1 000 seeds | Dimensions |
|---|---|---|
| | gram | mm. |
| Maritime region | 9.7 | length 2.6 x breadth 2.3 |
| Corncockle from the same region grown at Pétrograd | 9.08 | » 2.9 x » 2.3 |
| Province of Esthonia | 5.8 | » 2.2 x » 1.9 |
| Province of Volhynia | 9.0 | » 2.2 x » 2.4 |

The average impurity is 4.38 per cent for wheat and 2.61 per cent for rye.

As regards grain diseases the presence of smut on wheat and *Fusarium* on oats and wheat was noticed. Ergotted rye was not found, and its absence had already been indicated by other workers who had studied the maritime region.

CEREALS AND PULSE CROPS

1175 – **Results Obtained with the New Wheat Carlotta Strampelli in the Regional Experimental Fields in Italy** (1). — STRAMPELLI N., in *Minerva Agravia*, Year XIII, No. 11-12. pp. 123-125. Rome, June 15-30, 1916.

In 1914 the Italian Ministry of Agriculture made arrangements to establish several experimental fields in various agricultural institutes connected with the Ministry. The present paper is the report submitted to the Ministry, chiefly consisting of the various reports sent in by the directors of the agricultural institutes at which the trials were made.

The wheats raised by M. STRAMPELLI fall into two groups.

1) wheats suitable for the valleys of Central and Northern Italy (Gregorio Mendel, Carlotta Strampelli).

2) wheats able to stand drought, suitable for growing in Southern Italy (Dauno, Apulia, Majorca, Strampelli).

As the year 1915, during which the experiments were carried out, was exceptionally wet, the tests made with the second group were valueless. On the other hand, those made with the first group of wheats were specially favoured by the conditions. The experimental results obtained with Carlotta Strampelli wheat are summarised in the following table

At the State School of Viticulture and Wine-Making at Avellino M. GIULIO PARIS tested the effect of liberal nitrogenous manuring (176 lbs sodium nitrate per acre) on the wheats Carlotta Strampelli, Gregorie Mendel and Risciola. The manuring caused the two latter to lodge ; the former did not go down, and it yielded 2 787 lbs of grain per acre.

Tests in different parts of the country will be again repeated before the

(1) See also Dr. G. PATANÈ, The Selection of Cereals in Italy, in *R.* June 1916, pp. 831-842. (*Ed.*)

(2) See *R.* 1915. No. 167. (*Ed.*)

| Where and by whom tested | Yield par acre | Remarks |
|---|---|---|
| | lbs | |
| tate School of Agriculture, Caluso (Turin province) . . | — | Varieties sent from the Rieti station gave higher yields than the others tested; they also proved less liable to lodging and disease, especially rust. |
| gricultural organiser of Fabriano . . . . . | 1 764 | Other yields were: Granella di Carpegna . 1 253 lbs Gregoire Mendel. . . . 1 235 » Bordeaux . . . . . 1 137 » The varieties kept the same order in their resistance to rust. |
| gricultural organiser of Ferrara . . . . . | 2 646 | Higher yield than whit Inversible Vilmorin, Gentil rosso originario, Hybrid 40 Passerini. Rosso Olona, Gentil rosso bolognese N° 16, Cornia. |
| tate School of Agriculture, Imola . . . . . | 2 452 | Proof against lodging and rust; free from smut. |
| tate School of Agriculture of Padua (at Brusegana) . . . | 2 999 | Very suitable for growing in moist districts. |
| tate School of Agriculture of Pozzuolo in Friuli . . . . | 2 425 | Not at all liable to rust or lodging. |
| tate School of Agriculture, Voghera . . . . . | 2 576 | Better results than with Rieti, Inversible Vilmorin, Gros Bleu etc. |
| tation Beetroot for Testing, Rovigo . . . . . | 3 042 | Distinguishd by its earliness, heavy yield and resistance to rust. |

new variety is distributed to the public, but up to the present the wheat Carlotta Strampelli, which has given very high yields (up to 3616 lbs per acre) on the Rieti plain without lodging has proved to be equally upstanding in the local test. This resistance to lodging is due to its anatomical structure, as it is rich in radially elongated fibro-vascular bundles arranged in several rows. This structure enables the straw, to bend without breaking, even though battered by the wind and heavy rains. Provided the soil is free from weeds, especially those with climbing stems, the straw recovers itself completely very soon after the storm is over.

1176 – **Hybrid Wheats, Gentil rosso × Noé, obtained by Professor Passerini** (1). — TARUFFI D. *in Giornale di Agricoltura della Domenica*, Year XVI, No. 39, p. 341. Piacenza. September 24, 1916.

Professor PASSERINI has endeavoured to obtain by breeding a variety of wheat with all the good qualities of Gentil rosso, but less liable to

(1) See also, in *R.* June 1916, pp. 831-842, original article by Dr. G. PATANE; "The selection of cereals in Italy".

lodge. Noé was chosen for the second parent because it does not lodge easily and because it has a lower habit and a thicker and more lignified straw than Gentil rosso. Noé possesses two bad characters which need to be eliminated : 1) its liability to rust, caused by late ripening, 2) the exceedingly coarse quality of the straw.

These experiments were begun before 1900 and have been carried out at the Agricultural Institute of Scandicci (Florence) ; they have shown that the cross Gentil rosso × Noé is more successful than the reciprocal cross. After rigorous selection only two of the hybrids have been chosen, known by the number 40 and 46. These hybrids differ essentially from Gentil rosso in that they are of lower habit and that the plants are glaucous like Noé. The ears are hardly any shorter than those of Gentil rosso ; the spikelets are more fan-like at the time of ripening ; the awns of the glumes are stouter and shorter. The grains (caryopses) are light red in colour and somewhat resemble those of Gentil rosso. No. 40 has a very elongated ear which is more like that of Gentil rosso, while No. 46 has a dumpy, thicker ear resembling that of Noé. In the shape of the grains No. 40 comes nearer to Gentil rosso than No. 46 does to Noé.

These hybrid wheats have also been cultivated on the Experimental Farm of the Perugia High School and by various Tuscan farmers of Valdichiana and Valdinievole. They have shown marked productivity and higher degree of resistance to lodging than Gentil rosso, even when heavily manured.

1177 – **Two Good Varieties of Italian Wheat, Gentil rosso and Gentil bianco.** — DE ROSA A., in *Il Coltivatore*, Year 62, No. 26, pp. 234-239. Casale Monferrato, September 20th 1916.

The wheats Gentil rosso and Gentil bianco, have been extensively cultivated in Tuscany from very early times. They spread from this country to many parts of North and South Italy giving excellent results everywhere. The two varieties possess the following qualities : good yield ; great adaptability (particularly Gentil rosso); good resistance to rust and lodging ; high food value. Gentil rosso is suitable for late sowing so that it may also be used as a spring wheat. Both varieties are suitable for cool or even cold districts, and prefer light or heavy loams in good heart. Gentil rosso is less exacting than Gentil bianco as regards soil. The former is chiefly used for bread making.

The following characters distinguish the two varieties.

*Gentil rosso* — *Ear* : Elongated, oblong in section ; glabrous ; colour tawny, with brown tints shading to red at the edge of the glumes.

*Spikelets* : Rather crowded, glumes fairly long, awned in an increasing degree from the base to the tip of the ear.

*Grain* : Elongated, size average, heavy, colour reddish with darker shades, fracture distinctly starchy.

*Gentil bianco.* — *Ear* : Elongated, square in section ; glabrous, white with clear yellow shades.

*Spikelets* : Not very crowded ; glumes swollen, slightly keeled in the upper $^2/_3$ somewhat awned.

*Grain*: Rather plump; size average; heavy; colour yellow; starchy fracture.

*Physico-chemical characters of the grain and flour of the wheats Gentil rosso and Gentil bianco.*

| | « Gentil rosso » | « Gentil bianco » |
|---|---|---|
| Average weight of 100 grains . . . . . grams | 5.4966 | 5.6568 |
| Weight of 1 litre of grains . . . . . » | 800.00 | 808.45 |
| Volume of 1 kilogram of grains . . . . . litres | 1.250 | 1.244 |
| Average weight of 1 hectolitre of grains . . . . . kgs. | 80.000 | 80.345 |
| Volume of 100 kilograms of grains . . . . . litres | 125.000 | 121.463 |
| Number of grains in 1 kilogram . . . . . | 18.200 | 17.680 |
| 100 kgs grain ground in a stone mill and sifted with a 0.5 m.m. sieve yield: | | |
| flour . . . . . kgs. | 81.153 | 80.000 |
| bran . . . . . » | 18.847 | 20.000 |
| Kilograms of water needed to make bread from 100 kilograms of flour . . . . . | 56.390 | 52.500 |
| Kilograms of bread obtained from 10 kg dough . . . . | 83.310 | 87.628 |
| Kilograms of bread obtained from 100 kg flour . . . . . | 104.610 | 127.500 |
| Loss of weight from the dough caused by: | | |
| *a*) fermentation during bread making . . . . . | 6.06 | 4.59 |
| *b*) baking . . . . . | 11.68 | 12.37 |
| *Composition of flour* (1916 crop): | | |
| Moisture . . . . . % | 9.70 | 10.60 |
| Acidity . . . . . % | 0.057 | 0.068 |
| Moist gluten . . . . . % | 27.40 | 26.80 |
| Starch . . . . . % | 64.98 | 64.26 |
| Reducing substances . . . . . % | 3.42 | 3.38 |
| Nitrogen . . . . . % | 2.080 | 2.038 |
| Protein matter . . . . . % | 13.00 | 12.74 |
| Fats . . . . . % | 1.85 | 1.89 |
| Ash . . . . . % | 0.78 | 0.82 |

1178 – **Seeding Experiments with Single Grains of Wheat.** — MANCINI C., in *La Rivista Agricola*, Year XII, No. 263, pp. 293-294. Rome. Sept. 16, 1916.

The experiments have been made in ordinary soil of good quality but not of exceptional fertility, which might be considered as second-class for wheat cultivation. The variety " Romanello " was planted on

October 25th. on plots of 120 square yards. Plot I was sown with single grains 4 inches apart each way ; Plot II was also sown with single grains, but 8 inches apart each way ; Plot III, which served as a control was sown in the ordinary way, in rows 16 inches apart. The season was not very favourable, because of the dry spring.

The results of the experiment are given in the following Table :

| Plot number | Distance between the grains | Number of grains sown per sq. yd. | Weight of grain sown per sq. yd. | Crop obtained per sq. yd. | (Crop Seed sown) | Crop per acre |
|---|---|---|---|---|---|---|
| | | | oz. | oz. | | lbs. |
| I . . . . . | 4 inches | 84 | 0.06 | 6 | 100 | 1 700 |
| II . . . . . | 8 inches | 42 | 0.03 | 3 | 100 | 880 |
| III . . . . | in rows | 420 | 0.3 | 3 | 10 | 440 |

It is thus seen that by sowing only 0.06 oz. of seed per square yard, equivalent to 18 lbs. per acre, a crop of 1760 lbs. of grain per acre was obtained, in spite of the unfavourable season. By this method 72 lbs of seed may be saved per acre.

1179 – **The Time to Seed Wheat in Kansas.** — Call L. E. Salmon S. C., and Cunningham C. C., in *Kansas State Agricultural College, Agricultural Experiment Station, Bulletin* No. 213, pp. 1-16. Kansas, July 1916.

An account is given of investigations as to the best time to sow wheat when climatic conditions (cold winter, very dry summer etc.), the attacks of Hessian fly (*Cecidomya destructor* Say), and other intervening factors are taken into consideration. The damage caused by Hessian fly has been estimated at 16 million dollars (about £ 3 333 333) for 1915 and 15 million dollars (£ 3 125 000) for 1916. Experiments have been carried out for four years and it seems that in central and eastern Kansas wheat may be sown late enough to avoid most of the injury from Hessian fly, yet early enough on well prepared ground to secure a good growth before winter.

The best date for seeding in north eastern Kansas varies from about September 25 th, to October 3rd ; in south central Kansas from about September 25th to October 7th ; and in north central Kansas from about September 20th to October 1st. The time for seeding in western Kansas depends on the rainfall. It is usually not advisable to seed in dry ground. The land should be prepared early, and seeded when in proper condition to insure germination and good growth.

Wheat may be sown later in rich soil and well prepared ground than in soil that is poor or poorly prepared. Early and thorough preparation not only destroys many of the flies in the stubble, but also enables the wheat to make a more rapid and vigorous growth. Strong wheat plants are damaged less by Hessian fly, and stand more severe winter weather, than

plants which are small and weak. Wheat should be sown somewhat thicker when planted late. Late planted wheat often germinates less freely and usually tillers less, than wheat sown earlier, as is shown in the following Table.

*The effect of the time of seeeding on the tillering of wheat.*

| Date of seedinges | Number of tillers per plant | | | | |
|---|---|---|---|---|---|
| | 1912 | 1913 | 1914 | 1915 | Average 4 years |
| September 8 to 11, inclusive . . | 5,8 | 4,8 | 4,8 | 3,6 | 4,7 |
| September 13 to 19, inclusive . | 6,0 | 4,1 | 4,2 | 4,9 | 4,8 |
| September 21 to 25, inclusive. . | 4,3 | 3,1 | 3,8 | 4,1 | 3,8 |
| September 27 to October 2, inclus. | 2,7 | 3,0 | 3,7 | 3,7 | 3,3 |
| October 4 to 9, inclusive . . . | 1,8 | 2,1 | 3,2 | 2,8 | 2,5 |
| October 11 to 17, inclusive. . . | 1,4 | 1,1 | 1,9 | 2,4 | 1,7 |

1180 – **A Study of the Problem of Forage Production in Uruguay, dealing with the use of Artificial Inoculation in the Lucerne Fields.** — MOREIRA A. S., and MENDIZABAL M. F. in *República Oriental del Uruguay, Ministerio de Industrias, Inspección Nacional de Ganadería y Agricultura*, Bulletin No. 18. Montevideo, 1916.

FORAGE CROPS, MEADOWS AND PASTURES

In order to increase the forage production in Uruguay the following crops have been tried:

1) Grass and clover mixtures.
2) Oats.
3) Lucerne.

All these have been more or less unsuccessful. Owing to the geological formation of the soils in Uruguay it is not possible to establish permanent stands of lucerne, as has been done in the Argentine pampas, where the plant continues productive for more than 40 years.

As lucerne could not be grown under irrigation in the fields of the National Inspectorate of Livestock and Agriculture, experiments were made to see whether it could be grown with the aid of deep ploughing and inoculation of the fields with nitragin obtained from the United States Department of Agriculture. In the present paper the results of the second set of experiments are given.

*Preparation of the soil.* — The experimental plots measured 16 ½ × 33 feet, and were on a very light sandy soil containing a fair amount of humus, which had been under potatoes from the spring of 1914 to the middle of January 1915 and had then been left fallow till the beginning of May. The plots were worked to a depth of 19 inches and were then harrowed on May 20th.

*Time and method of sowing; quantity of seed used.* — The four plots

TABLE I. — *Analyses of lucerne hay from plots inoculated with nitragin and from non-inoculated plots (per cent of dry matter at 110° C.).*

| | Organic matter | Ash | Crude fat | Cellulose | Nitrogen | Protein | Phosphoric acid in ash | Calcium oxide in ash | Nitrogenous matter in extract | Acidity expressed as acetic acid | Starch value KELLNER |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Lucerne hay*: | | | | | | | | | | | |
| 1) With nitragin mixed with seeds | 89.87 | 10.13 | 2.61 | 22.59 | 3.49 | 21.81 | 0.71 | 2.27 | 40.55 | 2.09 | 51.14 |
| 2) With nitragin mixed with soil | 88.90 | 11.09 | 2.86 | 21.95 | 3.55 | 22.19 | 0.75 | 2.00 | 41.86 | 2.06 | 46.09 |
| Average of inoculated plots | 89.38 | 10.61 | 2.73 | 22.27 | 3.52 | 22.00 | 0.73 | 2.13 | 41.20 | 2.07 | 48.61 |
| Control for plot 1 | 89.08 | 10.92 | 2.59 | 24.11 | 3.30 | 20.63 | 0.72 | 2.14 | 44.08 | 1.98 | 53.20 |
| Control for plot 2 | 88.69 | 11.30 | 2.65 | 22.78 | 2.79 | 17.44 | 0.84 | 1.15 | 45.80 | 2.76 | 51.92 |
| Average of non-inoculated plots | 88.88 | 11.11 | 2.62 | 23.44 | 3.04 | 19.03 | 0.78 | 1.64 | 44.94 | 2.37 | 52.56 |
| *Leaves*: | | | | | | | | | | | |
| 1) With nitragin mixed with seeds | 87.14 | 12.16 | 3.06 | 23.82 | 4.49 | 28.06 | 0.90 | 2.65 | 32.19 | 1.74 | 59.67 |
| 2) With nitragin mixed with soil | 86.92 | 13.10 | 2.93 | 20.92 | 3.76 | 23.50 | 0.85 | 2.49 | 39.54 | 2.06 | 51.85 |
| Average of inoculated plots | 87.03 | 12.63 | 2.99 | 22.37 | 4.12 | 25.75 | 0.87 | 2.57 | 35.86 | 1.90 | 55.76 |
| Control for plot 1 | 85.90 | 14.09 | 3.15 | 18.21 | 3.72 | 23.25 | 0.79 | 2.97 | 41.29 | 1.52 | 50.78 |
| Control for plot 2 | 88.70 | 11.29 | 2.41 | 23.25 | 2.87 | 17.94 | 0.71 | 1.93 | 45.10 | 1.87 | 51.92 |
| Average of non-inoculated plots | 87.30 | 12.69 | 2.78 | 20.73 | 3.29 | 20.59 | 0.75 | 2.45 | 43.19 | 2.69 | 51.35 |
| *Stems*: | | | | | | | | | | | |
| 1) With nitragin mixed with seeds | 93.60 | 6.39 | 1.40 | 44.18 | 1.85 | 11.56 | 0.52 | 1.29 | 36.45 | 1.68 | 50.84 |
| 2) With nitragin mixed with soil | 93.64 | 6.35 | 1.16 | 39.35 | 1.47 | 9.19 | 0.54 | 1.34 | 43.94 | 1.99 | 52.19 |
| Average of inoculated plots | 93.62 | 6.37 | 1.28 | 41.76 | 1.66 | 10.37 | 0.53 | 1.31 | 40.19 | 1.83 | 51.51 |
| Control for plot 1 | 92.57 | 7.20 | 1.29 | 37.93 | 1.74 | 10.88 | 0.55 | 1.25 | 42.66 | 1.09 | 51.82 |
| Control for plot 2 | 93.89 | 6.10 | 1.18 | 36.87 | 1.20 | 7.50 | 0.52 | 1.05 | 48.34 | 1.79 | 52.96 |
| Average of non-inoculated plots | 93.23 | 6.65 | 1.23 | 37.40 | 1.47 | 9.19 | 0.53 | 1.15 | 45.50 | 1.44 | 52.39 |

were sown with Grimm lucerne on May 21st with a Planet drilling machine, in rows 6 inches apart and ½ inch deep; at the rate of 17 ½ lbs. of seed per acre.

*Methods of inoculation.* Two methods were adopted:

1) On one plot the nitragin (17 ½ oz) was mixed with the seed (3 ½ oz) and the mixture was sown in drills. The objection to this method was that the dampness of the nitragin caused the drilling machine to work badly. To mitigate this as far as possible a little dry sand was added to the mixture, with good results. A non-inoculated plot served as a control.

2) The same quantity of nitragin was incorporated with the soil immediately before sowing. The nitragin was scattered by means of a sieve, raked in, and the seed sown directly. Again a non-inoculated plot was used as a control.

*Growth up to time of cutting. Diseases.* Germination began three days after sowing and was finished by the fifth day; this was attributed to the good quality of the seed and to the excellent condition of the soil, which was in good heart. After this, no further growth took place until July 16th, during the whole period of intense cold. Uniform growth followed on all the experimental plots until October 23rd, by which time a difference was evident beteen the inoculated and control plots. The former showed a more tufted growth and a deeper green colour.

During the whole period of vegetative growth the climatic conditions were not very favourable.

At the end of September the presence of a cryptogamic disease (*Pseudopeziza Medicaginis*) was noticed. The inoculated plots showed a resistance to this disease which can only be attributed to the nitragin.

*Chemical analysis. Nutritive value.* — The figures set out in Table I show that the difference in the composition of the crops from the inoculated and non-inoculated plots is not great enough to be established by a single analysis. The only well marked difference is that the crops from the treated plots were larger than those from controls. (Table II).

TABLE II. — *Yields of Lucerne from Inoculated and non-inoculated plots.*

| | First cutting | | | Second cutting | |
|---|---|---|---|---|---|
| | Yield per acre | | Hay in green crop | Yield per acre | |
| | Green crop | Air-dried hay | | Green crop | Air-dried hay |
| | lbs. | lbs. | per cent. | lbs. | lbs. |
| 1) Nitragin mixed with seed . . | 6 821 | 1 902 | 27.88 | 9 856 | 2 742 |
| 2) Nitragin mixed with soil . . | 6 856 | 2 003 | 29.21 | 10 921 | 3 096 |
| Control to 1 . . . . . | 4 083 | 1 193 | 29.22 | 8 721 | 2 345 |
| Control to 2. . . . . | 4 057 | 1 264 | 31.14 | 7 744 | 2 162 |

Although the yield from the inoculated plots was almost double at the first cutting, it remains to be seen whether the difference will reappear in later cuttings.

On the basis of yield in green or dry weight at current prices, inoculation resulted in a financial gain of 27*s* 6*d* per acre, taking the average yield of the first cutting of the two test plots compared with that of the controls. In commercial dealings with forage in Uruguay the price is never based on the feeding value.

*Discussion of results and conclusions.* — The following conclusions are based only on the results of the first cutting, and further data are necessary to confirm them:

1) The influence of nitragin does not manifest itself during the periods of germination and early growth.

2) During the period preceding flowering the effect of nitragin shows itself in increased and more vigorous growth.

3) The yield from inoculated lucerne fields is greater than that from untreated fields.

4) Inoculated lucerne fields offer greater resistance to the attacks of *Pseudopeziza Medicaginis*.

The figures of the second cutting, given in Table II, confirm the foregoing conclusions.

1181 - **The Forage Question in Aragon, Spain.** — Lapazdrán J., in *Ministerio de Fomento, Dirección general de Agricultura, Minas y Montes*, Year X, No. 16, pp. 1-16. Madrid, August 1916.

The objection to lucerne growing arises chiefly from the fact that this crop occupies the land for several years, and the suggestion is made that it should be replaced by clover or, better still, by *Vicia villosa* (winter or spring varieties) or by *V. sativa* (autumn variety). The vetches do not occupy the land for more than 8 or 10 months, so they may be grown as a catch crop on the cereal stubble before the ground is occupied the following season by transplanted mangels or maize grown for grain.

On well worked and manured Aragon soils which are not too damp the yield of vetches is 11 to 12 tons per acre of green forage or 2 ½ to 3 tons of hay per acre.

*Rotations used in the provinces.*

| State Experimental Farm of Saragossa | Non-irrigated new soils |
|---|---|
| 1) Sugar beet | 1) Fallow |
| 2) Wheat or clover | 2) Oats |
| 3) Clover | 3) Vetches |
| 4) Wheat | 4) Wheat |
| 5) Vetches and maize | |
| 6) Wheat or clover | |
| 7) Clover | |
| 8) Wheat | |

*Example of an average farm account for* 1 *acre of vetches, grown as a first crop on rather gravelly, calcareous clay soil, on the plain of Saragossa.*

EXPENSES.

| | s d | s d |
|---|---|---|
| *Preparation of the soil:* | | |
| 3 pairs of oxen for Jaén plough | 7 8 | |
| 4 " " " " Brabant " | 10 3 | |
| 3 " " " " " " | 7 8 | |
| 1 horse for harrow | 1 7 | |
| 4 days labour for preparing the soil for irrigation | 2 11 | |
| | | 30 1 |
| *Manure.* | | |
| 88 lbs. superphosphate, and cost of transport | 6 6 | |
| 1/2 day for labour for spreading manure | 4 | 6 10 |
| *Irrigation expenses.* | | |
| 2 days labour for irrigations | | 1 5 |
| *Cost of seeding.* | | |
| 112 pints of vetch seed | 14 4 1/2 | |
| 8 pints of oats for mixing in | 2 0 1/2 | |
| 1 day labour for sowing seed | 8 1/2 | |
| 3 pairs animals for covering seed | 5 9 1/2 | 22 11 |
| *Cost of hay making.* | | |
| 9 days labour for cutting | 8 8 | |
| 6 " " " making and loading hay | 3 6 | |
| 1 horse for 1 day to draw hay to barn | 1 7 | |
| | | 13 9 |
| *Rent of land and general expenses* | | |
| Reckoned together as 67*s* 2*d* of which one half is debited to the first crop (vetches) and the other half to the second crop | | 33 7 |
| Total Expenses | | 108 7 |

RECEIPTS.

| | |
|---|---|
| 2 tons 12 1/2 cwt. dry hay | 137 0 |
| *Net gain per acre* | 28 5 |

Estimating the value of the land at about £ 11 per acre the return would be about 25 per cent, half being made by the first crop and half by the second, over and above the improvement of the soil by the residues left by the leguminous plants.

1182 – **Experiments with Potash Manures on kops in Germany.** — ANCKER F., in *Wochenschrift für Brauerei*, Year 33, No. 35, pp. 273-275. Berlin, August 26, 1916.

STIMULANT, AROMATIC, NARCOTIC, AND MEDICINAL PLANTS

The report of the Berlin Experiment Station and School of Brewing is given on experiments made in 1915 to determine the influence of artificial manures on the quality of hops. Each experimental field was divided into 4 plots separated by one or two rows which are not included in the results.

At the beginning of the experiment each plot received the dressing of dung that is usually used in the district, and in addition the following manures were applied per acre.

Plot I. No artificial manure.
Plot II 115 lbs. sulphate of ammonia + 266 lbs. superphosphate.
Plot III 115 lbs. sulphate of ammonia + 266 lbs. superphosphate + 132 lbs. potassium salts (40 per cent).
Plot IV 115 lbs sulphate of ammonia + 266 lbs. superphosphate + 203 lbs. potassium salts (40 per cent).

With 1920 plants to the acre, each plant receives:

Plot II 0.19 oz. nitrogen + 0.40 oz. phosphoric acid.
Plot III 0.19 oz. nitrogen + 0.40 oz. phosphoric acid + 0.44 oz. potassium.
Plot IV 0.19 oz. nitrogen + 0.40 oz. phosphoric acid + 0.68 oz. potassium.

The farm yard manure was applied at the rate of 2 $^1/_4$ to 3 $^1/_4$ lbs per plant, and the artificials were spread from the end of March to mid-April.

The following are the details of the cultivation and the description of the soils used.

Experiment

1 Peaty sand, 10 to 12 inches deep; 240 plants per plot trained up poles.
2 Peaty sand about 1 $^1/_2$ inhes deep over sand; 260 plants per plot, trained up poles.
3 Peaty sand, over sandy subsoil; plants trained up poles.
4 Peaty sand to a depth of 16 inches, then ferruginous sand; 300 plants per plot trained up poles.
5 Peaty sand; 240 plants per plot, three-fourths trained on iron wire, one-fourth trained up poles.
6. Boggy soil; 270 plants per plot, five years old, trained up poles.
7. Peaty sand; plants trained up poles.
8 Peaty sand to a depth of 14 inches, then sand; 160 plants per plot, trained up poles.
9 No data.
10 Peaty sand; plants trained up poles.
11 Peaty sand 12 inches deep, over a sandy subsoil; plants trained up poles.
12 Peaty sand to a depth of 14 inches; subsoil sandy; 300 plants per plot trained on iron wire.

The *yield of dry hops* per 100 plants on the various plots was as follows:

| Experiment | Plot I | Plot II | Plot III | Plot IV |
|---|---|---|---|---|
| | lbs. | lbs. | lbs. | lbs. |
| 1 | 29.92 | 27.50 | 33.00 | 35.20 |
| 2 | 29.70 | 31.90 | 36.30 | 40.48 |
| 3 | 19.80 | 20.46 | 21.12 | 22.00 |
| 4 | 22.00 | 25.52 | 27.06 | 23.32 |
| 5 | 20.24 | 23.76 | 26.40 | 30.14 |
| 6 | 35.42 | 38.72 | 36.52 | 38.72 |
| 7 | 22.44 | 32.12 | 33.00 | 36.52 |
| 8 | 13.86 | 14.52 | 15.18 | 15.40 |
| 9 | 5.06 | 4.62 | 4.40 | 4.18 |
| 10 | 9.02 | 10.78 | 11.44 | 12.98 |
| 11 | 3.52 | 3.96 | 7.04 | 9.02 |
| 12 | 25.52 | 27.72 | 29.26 | 29.26 |

It appears from these results that artificial manure considerably increased the yield in nearly every case without causing any depreciation of quality.

The average amounts of bitter substances in the dry matter are:

| Plot | per cent |
|---|---|
| I | 17.24 |
| II | 17.35 |
| III | 17.28 |
| IV | 17.05 |

Thus no average increase in bitter substances is evident.

If, however, the individual experiments are considered it is found that the plots come in the order III, II, IV, I with regard to the *amount of bitter substances* they contain. In *type and size of the strobiles* the order is plot III, IV, II, I; in *lupulin content*, plot IV, III, I, II; in *colour of the hops* plot II, I, III, IV.

To sum up, from the point of view of quality plot III has given the best result seven times and plot IV five times, the other two plots never taking the first place. The conclusion may be drawn that the quality has been most improved on plot III. It is closely followed by plot IV, which comes second simply because the foliage of the plants was more luxuriant than on plot III.

1183 – **Preliminary Work at the Chemical Laboratory of the Soukhoum Experiment Station, Caucasus, on the Extraction of Medical Substances from Local Plants (Eucalyptus, Wild Mint, Camphor, Castor Oil, etc.).** — Козловъ М. Н. (Kozlov M. N.), *Черноморское Сельское Хозяйство* (The Agriculture of the Coast of the Black Sea), Year XIII, No. 1, 2, pp. 20-39. Soukhum, Jan.-Feb. 1916.

Numerous observations made by the Acclimatization Section of the Soukhoum Station have shown that it is quite practicable to cultivate species of Eucalyptus, rich in essential oils, on the Batum coast. The first attempt to extract these oils was successfully made in 1899-1900 by Beklemichev at his essential oil factory, but after his death the work was not carried on.

In order to throw further light on this question, investigations have been made on the leaves and stems of the following species: *Eucalyptus Globulus, E. Maideni, E. amygdalina, E. viminalis, E. pulverulenta, E. crebra* and others.

The quantity of essential oil in the eucalyptus is greatest in the spring and early summer. Beklemichev's researches showed that in September 0.8 per cent of oil was extracted from *E. Globulus*, 0.7 per cent in December, and 0.9 per cent in March. Tests made in September with *E. viminalis* gave 0.6 per cent. instead of 0.7 per cent; similar results were obtained with *E. pulverulenta*, which yield 1.8 per cent instead of 2.2 per cent. Fresh

leaves of *E. Globulus* yielded 1.1 per cent of oil, dried leaves gave 2 per cent ;in *E. vininalis* the figures were 0.6 per cent 1.24 per cent respectively. The drying of the leaves also resulted in smaller quantities of condensation water, so that the expense of fuel for distillation was less. On the other hand, dessication did not cause any loss of essential oil.

From the chemical standpoint *E. Globulus*, *E. Maideni* and *E. pulverulenta* may be classed together, as they yield very similar oils, containing over 40 per cent eucalyptol. It has been proved that these three species will grow well on the coast of Batum and that they can be cultivated on a large scale. The total leafage of *E. Maideni* is heavier than that of *E. Globulus*. This fact, together with the higher oil yield of the former species, must have some effect on the return from its cultivation. It has also been proved that the eucalyptus oil obtained from the Batum coast is not inferior in quality to that derived from other countries ; on the contrary, for *E. Globulus* and *E. Maideni* the quality is superior.

The probable expenses and receipts of the production and commercial extraction of essential oils may be summarised thus : capital for laying out plantations £ 19 per acre ; annual expenditure about £ 8 per acre ; a return of £ 19 4*s* to £ 22 8*s* per acre may be expected, representing interest at the rate of 13 to 30 per cent on a capital of £ 2600 to £ 3200, laid out on 25 to 50 acres of land and on the building of the factory.

Other interesting investigations have been made on wild mint (*Mentha Pulegium*) and Castor oil. The results are quite satisfactory ; the yield of essential oil from fresh mint was 0.4 per cent, and after drying in the air 1.09 per cent ; in castor oil seeds the proportion of oil reached 49.5 per cent.

By using the fresh leaves of a tree of *Cinnamomum Camphora* Nees. (about 20 years old), 0.9 per cent of raw camphor was obtained ; 22.6 per cent of the total quantity consisted of oil of camphor, the remaining 77.4 per cent being camphor. Experiments with large branches 1 ½ to 2 inches in diameter, gave negative results; no separation of solid camphor took place, but a small quantity (0.09 per cent) was obtained of an oleaginous substance with a peculiar smell which recalled that of camphor. (1),

(1) According to Prof. GIGLIOLI the distribution of camphor in the different parts of *Cinnamomum Camphora* growing in Italy is as follows:

| Number of analyses | | Proportion of camphor per cent |
|---|---|---|
| 97 | In fully developed green leaves | 1.20 |
| | In young leaves | 0.70 |
| 6 | In dried leaves | 2.18 |
| 14 | In young wood | 0.10 |

" It thus appears that only the foliage of the camphor tree should be used, the oldest leaves being taken by preference and dried. This applies at any rate, to those trees which are similar in species to those that are beconing less and less frequent in the forest of Japan and Formosa ,,. (*Ed.*).

1184 – **Cultivation and Marketing of Flowers and Early Produce on the Riviera from Toulon to Mentone.** — FONCIN M., in *Annales de Géographie*, Year XXV, No. 136, pp. 241-262. Paris, July 15, 1916.

The cultivation of flowers and early produce occupies the whole coast from Marseilles to Mentone, a zone which comprises a purely agricultural region. The land is undulating and the soil is very variable, including the alluvium on the plain of Hyères, the gneiss and mica-schists of Maures, the recent eruptive rocks of Esterel and finally the calcareous or marly sedimentary beds. It is because of the climate — a Mediterranean climate tempered with mild winters and dry summers — that the whole region is given over to agricultural pursuits. All the rain falls in the autumn and winter, and then it comes in heavy downpours. Sowing must be done after the rains to ensure a harvest before the end of spring, as only wheat, vines and fruit trees can stand the dryness of the summer. Attempts have been made to anticipate the rainy season by means of summer irrigations, carried out by utilising the subterranean waters or by diverting the water courses. All the seeds sown are obtained from cold countries, as they start into growth so much more quickly than those raised locally.

In the Maures there is a fairly brisk trade in wild flowers. Among cultivated plants the orange (harvested in May) and mimosa are prominent. Roses are grown in the open air and in glasshouses, carnations under matting (Hyères, Maures) or under handlights (shores of the Maritime Alps, especially at Antibes), violets as undergrowth in fields planted with olives or peaches. Ornamental plants are also grown. Kitchen gardens are almost entirely confined to the plain of Hyères. In fruit growing the cultivation of citrus fruits is is not very important ; peaches, cherries and figs are the trees which succeed best ; the grape is also a very important product.

In some cases the land is leased without payment in return for the clearing of some of the waste land. Some landlords insist on the growing of the old crops (vines, olives, wheat) as well as fruit and early produce. Under these circumstances the family of the tenant provides sufficient labour for the work. In other cases only flowers or early crops are grown, when labourers are necessary ; the land is taken on lease, usually for long periods. Finally there are big horticultural establishments devoted to glasshouse work only, which specialise in the cultivation of one or two plants (roses, carnations). The aim of each firm is to create a new variety but unfortunately there is no law of agricultural property to safeguard the rights of the creator of a new variety. In these great establishments the amount of labour employed is considerable. The figures referring to one such firm are as follows :

| | |
|---|---|
| Area of land cultivated | 37 ½ acres. |
| 80 carnation houses covering | 200 000 sq. ft |
| 60 rose houses covering | 60 000 sq. ft. |
| Frames | 14 000 |
| Output, per annum | 18 000 baskets |
| Working expenses | £4 000 |

| | |
|---|---|
| Cost of straw | £48 |
| Cost of string | £48 |
| Upkeep of frames | £68 |
| Plumbing etc. | £120 |
| Labour | £2 400 |

The flowers are sent away by parcels post, in reed packages lined with paper or wadding to keep out the cold. The very delicate fruits buried in wood packing, travel in boxes, while the more hardy vegetables content themselves with baskets and even sacks. Only the very earliest spring crops, fruits or vegetables, benefit by more dainty packing in little boxes or quite small flats, which are forwarded by parcels post. The journey is very rapid, the goods reach Paris in 20 $^1/_2$ hours, Frankfort on-Main in 33 hours, London in 38 ½ hours, Brussels in 39 hours, Pétrograd in 87 hours and Moscow in 95 hours.

From the agricultural point of view, flowers and early produce have taken the place of wheat, which used to be grown in the rows between the vines. The olive trees have begun to be neglected; only the vine holds its own. The change of crops has had a great influence on the life of the region and has modified the distribution of the population, hitherto crowded together in the villages and old towns; today these old villages are replaced by scattered dwellings in proximity to the gardens and the transport centres. The influence of the new method has also made itself felt by developing relations with other countries and by giving an impulse to cooperation.

The growing of flowers and early crops has greatly increased the wealth of the country, the value of the products sold each year reaching £ 2 200 000; it has also resulted in the creation or development of such industries as perfumery, distilling, confectionery and the manufacture of packing materials. Finally it has exercised an ethnographical influence by encouraging the immigration of foreign labourers who frequently settle down to live in the country.

FRUIT GROWING

1185 – **Mountain fruit Growing in Switzerland: Varieties Introduced from Russia, Sweden and Denmark.** — See No. 1158 of this *Bulletin*.

1186 – **Banana Growing in New South Wales.** — *The Fruit World of Australasia*, Vol. XVII No. 8, p. 270. Melbourne, August 1, 1916.

The cultivation of the banana is extending rapidly in the districts of Tweed and Brunswick River. Orchards of commercial importance planted with the variety Cavendish, which is much superior to the ordinary banana in quality and aroma, occur chiefly at Terranora, Piccabeen, Bilambil and Cobaki. 300 to 400 plants are grown per acre, and the plantations are usually from 10 to 25 acres in extent, but some are much larger. The first crop of 1 cluster of bananas per plant is gathered from 16 to 24 months after planting; the following year the crop increases to 4 or 5 clusters per plant. In 1915, at Bilambil, the crop from one plantation was valued at £ 2320, a gross return of £ 232 per acre.

The cost of planting one acre with 400 banana trees varies from £ 10 o £ 14 10s. according to the price of the plants, which ranges from £ 1 12s to £ 2 8s per hundred. Land suitable for banana growing costs from £ 29 o £ 54 per acre, and plantations in full bearing are valued at about £ 96 per acre.

1187 – **Effect of Drought on the Size of Grapes.** — RAVAZ L., in *Le Progrès Agricole et Viticole*, Year 33, No. 35, pp. 199. Montpellier, August 27, 1916. VINE GROWING

During the prolonged drought of the summer of 1916 in the South of France some measurements were made of the sizes of grapes.

*Diameter of Aramon Grapes.*

| Number in order on the bunch | Normal vine | Vine suffering from drought |
|---|---|---|
| — | mm | mm |
| No. 1 | 22.5 | 18.5 |
| No. 2 | 23.0 | 16.2 |
| No. 3 | 22.7 | 17.4 |
| No. 4 | 23.4 | 16.5 |
| No. 5 | 22.5 | 18.3 |
| No. 6 | 23.3 | 16.4 |
| Average | 23.2 | 17.2 |

Being given that volumes are to one another as the radii raised to the third power the ratio 1549.29 : 636.05 is obtained ; in other words, the berries which have suffered from drought are nearly three times as small as normal grapes.

1188 – **Spanish Forests and Paper Manufacture.** — ELORRIETA O. in *Resumen de Agricultura*, Year XXVIII, Part 9, pp. 399-402. Barcelona, September 1916. FORESTRY

The Spanish market uses annually 28 000 tons of paper, of which newspapers account for one half. Spain produces 15 000 tons of mechanical pulp per annum, from which an approximately equal weight of paper is manufactured. Consequently she is obliged to import 3 000 to 4 000 tons of mechanical pulp and 10 000 tons of chemical pulp.

*Trackless forests.* — It is asserted that there is sufficient wood in Spain to cover the amount of the imports and that it is the lack of roads which hinders the working of the woods under economic conditions. In Spain the raw material for paper making is not very costly, but no-one cares about it and the forests remain practically unused. As an instance may be cited the magnificent fir woods of the Aran valley consisting of *Abies pectinata*, the species best adapted to paper making. A beginning was made in the management of 37 500 acres, and the yield from these forests reached nearly 16 000 cubic yards. Unfortunately the work was stopped on account of administrative difficulties connected with boundaries and other questions of secondary importance.

*Workable woods.* — In the Pyrenees of Aragon and Catalonia, chiefly in the provinces of Huesca and Lerida, there are 122 500 acres of firwoods capable of providing 39 000 cubic yards of wood per annum. As the wood

has a high moisture content this quantity would make about 15 000 tons of mechanical pulp or 10 000 of chemical pulp, which is nearly enough to tide over the crisis that the war has caused in the paper trade. It does not seem possible to work these 122 500 acres in an intensive manner all at once, and it is suggested that the working of the Aran valley, mentioned above should be continued; the 39 000 cubic yards of wood obtained would be equivalent to 6 000 tons of mechanical pulp or 4 000 tons of chemical pulp.

The remainder could be provided by the pine forests (*Pinus sylvestris*) of Soria, Burgos, Sierra Carpetana and Cuenca. The Spanish pine wood contains more resin than that from the Baltic and Sweden and consequently is less suitable for paper manufacture. Nevertheless this species occurs at various altitudes, and it is probable that *Pinus sylvestris* from the dense woods of the higher parts of the country closely resembles that from Northern Europe.

The conclusion is drawn that the problem of providing raw material for paper making could be solved if the Forest Administration were to take the matter up seriously.

*Transport.* — This is a more difficult problem to solve than the preceding one. In practice the freight from Sweden to Spain, to Pasajes (Guipuzcoa province) is lower than the cost of transport from Sierra Guadarama (province of Madrid and Ségovia) to Guipzcoa or Biscay, where important Spanish paper factories are situated. The Government may prevail upon the railway companies to concede a lower tariff, but it cannot improvise means of road transport.

The Spanish paper industry has a producing capacity great enough to meet the needs of the country ; the Spanish Papermaking Company is responsible for 68 per cent of the total output. Apparently means are available to produce the whole of the mechanical pulp necessary, but not the chemical pulp, because the manufacturers are not provided with the needful plant. The paper factory at Villalba (Navarra) is an exception to this, as it produces a small quantity of semi-chemical pulp.

Replanting with poplars, especially Canada poplar, is suggested as a means of providing the most rapid solution of the problem, while at the same time it would give a return of 12 to 14 per cent on the capital outlay.

## LIVE STOCK AND BREEDING

FEEDS AND FEEDING

1189 - **Influence of Feeding with Milk rich in Carbohydrates (Diafarinised) and Milk rich in Fat (Emulsion Milk) of Varying Protein Content, on the Composition of Young Pigs** (1). — WELLMANN, O. (Zootechnical Institute of the Royal Veterinary School of Budapest) in *Kiserletügyi Kozlemenyek* (Communications of the Agricultural Stations of Hungary) Vol. XIX, Part 1, pp. 84-164, 35 tables (German summary pp. 165-167). Budapest, January to June 1916.

In these experiments young male pigs of the Berkshire breed were fed from the 23rd to the 39th day on a ration composed partly of diafari-

(1) See *R.* January 1916, No. 89.

ised milk (skim milk to which flour-starch saccharified by a preparation of diastase has been added) and partly of emulsion milk (skim milk emulsified with a cheap substitute for milk fat). These rations had the nutritive ations: narrow (1 : 2.5); fairly narrow (1 :4.5); fairly wide (1 :5.8) and wide (1 : 7.8). Twelve pigs were employed bred in the pigstys of Kisber (Hungary) of ages ranging from 4 to 12 weeks and weighing from 11 to 40 lbs. They were divided into groups of three proceeding from the same litter, two of each group being submitted to experiment, the third acting as control. The latter was slaughtered at the beginning of the experiment in order to determine the composition of those parts of the subjects experimented on, which were concerned in the increase of weight.

The organs of the slaughtered animals were divided into 10 to 12 groups, the whole organ being studied except in the case of the muscles, bones, skin and connective and fatty tissues, for which only half the animal was taken. The dry matter, fat, ash, nitrogen, glycogen and calorific value were determined. The results obtained were as follows.

1) The pigs fed on milk having a narrow nutritive ratio put on more flesh but less fat than did those fed on a ration poorer in protein. The bones of the young animals were relatively heavier than those of the older subjects which had been subjected to intensive feeding.

2) Analysis proved that the nitrogen (*i. e.* the dry matter less the fat and ash) is the most constant constituent of the young pig's organism, whilst the fat and ash are the most variable. Age influences the composition, in the sense that the older animals contain less water and more fat and have a higher calorific value than the younger animals.

The nature of the feeding had a marked effect on the composition of young pigs. Thus, compared with milk rich in carbonhydrates, milk, rich in fat increased the content of dry matter, dry matter less fat, dry matter less fat and ash, ash, nitrogen and the calorific value. *Per contra*, it diminished the proportion of water and depressed the ratio of the aforesaid constituents and water.

The composition of young pigs was greatly influenced by the nutritive ratio of their food. The ration having a wide nutritive ratio increased the proportion of dry matter and of fat, and the calorific value.

3) The best criterion of the influence of feeding was afforded by the composition of and increase of live weight during the experiment.

4) The distribution of the nutritive elements and the calorific value in the different parts of the organism was as follows:

With the oldest animals, the connective and fatty tissues as well as the muscles contained the greater part of the total dry matter; the other organs the lesser part.

When the milk ration had a wide nutritive ratio the dry matter of the connective tissue was increased at the expense of the muscles.

The effect of food rich in fat was to favour the fixation of dry matter in the bones and muscles when compared with food rich in carbohydrates.

The greater part of the water (about half the total) was found in the

muscles. The brain, bones and muscles of the older animals contained less water than did those of the younger subjects.

Comparing the behavious of milk rich in carbohydrates with that of milk rich in fat, the latter diminished the fixation of water in the connective tissue and increased it in the muscles.

The total ash was distributed as follows: the bones contained 65 to 76 per cent. and the muscles about 15 per cent. In comparison with those of young pigs fed on emulsion milk, the bones of animals fed on diafarinised milk contained the least quantity and the muscles the highest quantity of ash.

The muscles contained the greater part (about half the total) of the nitrogen found in the body of the young pig. The fatty and connective tissues contained 36 to 60 per cent. of the chemical energy, the muscles 28 to 41 per cent. and the bones 6 to 10 per cent. Milk having a wide nutritive ratio increased the energy reserve of the connective and fatty tissues to a marked degree.

5) Analysis of the different organs gave the following results.

The blood of the animals experimented with, particularly of those fed with emulsion milk, contained less dry matter than did the blood of the control animals.

The lungs, heart, glands, bones, skin, connective and fatty tissues, muscles and intestines of the older animals contained more dry matter, fat and energy than did the same organs of the younger subjects. Compared with milk rich in carbohydrates milk rich in fat increased the dry matter, the dry matter less fat, the ash, the nitrogen and the calorific value. Milk having a wide nutritive ratio increased the dry matter, the fat, and the calorific value.

The nature of the feeding had a considerable influence on the composition of the bones. Milk rich in fat, as compared with milk rich in carbohydrates, increased the ash content to a very marked extent.

6) The dry matter of the liver contained 0.16 to 0.74 per cent. of glycogen; that of the muscles 0.4 to 11.6 per cent. from which it is calculated that the liver of the young pig contains 0.53 to 8.72 grms, the muscles 0.71 to 5.91 grms of glycogen.

The writer has estimated the glycogen in the fresh liver and muscles of two young pigs, each weighing 11 lbs. The animal fed on diafarinised milk contained 34.2 grms, that fed on emulsion milk 13.9 grms, the liver and muscles of the first thus containing 2 ½ times as much glycogen as did those of the second. Hence the greater part of the glycogen is probably decomposed during drying.

7) The proportion of fat and carbohydrates in the food are held to be of equal interest to the physiologist and to the practical feeder. It is found that, as compared with food rich in fat, food rich in carbohydrate stimulates an increase of the water content of the organism and has a unfavourable influence on the fixation of dry matter less fat and ash.

The mean results obtained when using two young pigs from the same litter, fed side by side, one on diafarinised milk the other on emulsion mil

having the same nutritive ratio, showed that the animals responded differently. For an increase in weight of 22 lbs, the animal fed with emulsion milk produced 4.2 lbs of dry matter less fat and 13.8 lbs. of water, whilst that fed with diafarinised milk fixed 17.24 lbs. of water in the organism for the same quantity of dry matter less fat, the excess of water in the latter animal being 3.46 lbs. or 25 per cent. Of this excess 0.94 lbs. belonged to the skin and connective and fatty tissues : 1.1 lbs. to the muscles ; 0.60 lbs. to the bones ; 0.81 lbs. to the other organs ; *i. e.* the water content of the connective tissue increased 45 per cent ; of the bones 35 per cent ;. of the muscles 26 per cent. ; and of the other organs 23 per cent.

The origin of this excess of water must be attributed more especially to the glycogen, for, during the metabolism of the fat the water derived from the glycogen probably remains in the tissues.

1190 – **Influence of Feeding Pigs with Spoiled Maize upon the Composition of the Fat.** — See this *Bulletin* No. 1221.

1191 – **Investigations on the Poisoning of Poultry by Corn Cockle (*Agrostemma Githago*) in Hungary.** — DEGEN, A. (Royal Hungarian Seed Testing Station Budapest), in *Kiserletügyi Kozlemenyek* (Bulletin of the Hungarian Agricultural Station) Vol. XIX, Part I, pp. 11-21. Budapest January-June 1916.

As great difference of opinion exists among writers (LEPMAN, BOHMER, POTT, HONCAMP, NEUMANN, MULLER, KLING, ROBERT, TORMAY, HAGEMANN, HANSEN, MEISSL, etc) as to the toxicity of the siftings of certain cereals, particularly corn cockle (*Agrostemma Githago* the writer (director of the Royal Hungarian Seed Testing Station) has made a fresh experimental study of the question in the following way. 1) All cases of illness and death of animals fed with food containing siftings of grain were examined minutely ; 2) the services of an expert were engaged ; 3) feeding trials were made with the supposed toxic substance in conjunction with the Animal Biology and Nutrition Station ; 4) Help was sought from the Veterinary High School.

In June 1915, 280 geese perished at Pestszentlorie, through the consumption of a meal, purchased by the breeder as meal No. 8 but really originating from a sifting containing 40 to 50 per cent of the seeds of *Agrostemma Githago*. With the same meal the Animal Biology and Nutrition Station undertook feeding trials on three fowls and three geese. During a preliminary period of six days the six animals were fed with maize grain. After this preparatory period one fowl and one goose received at 7.0 a. m. respectively 50 and 100 grms of the meal in question At about 10 a. m. the two animals exhibited symptoms of poisoning, and died at about noon. The two other fowls received the same meal gradually thus : 1st day : *a*) 80 grms of maize + 20 grms of meal containing corn cockle ; 2nd day : *b*) 60 grms of maize, 40 grms of the meal ; 3rd day : *c*) 20 grms of maize, 80 grms of the meal. One of the fowls died after having taken ration *b*), the other after ration *c*). One of the geese succumbed after a ration of 120 grms of maize, 80 grms of the same meal, whilst the other resisted the meal better because it had rejected the greater part of the ration on three successive

days. In order to prevent vomiting the quantity of water was diminished. From the fourth day the goose received only a ration of 100 grms of the meal and it died on the 6th day. The autopsy of the dead animals performed by the Pathological Department of the Veterinary High School diagnosed for the three geese : inflamation of the aesophagus : serous circumoesophageal inflammation : inflammation of the small intestine : hemorrhage of the visceral membrane of the pericardium. An hemorrhagic inflammation of the stomach was also observed in the three geese, caused by numerous *Strongylus nodularis*, which developed independently of the absorption of the toxic substance. Of the three fowls two suffered from an acute inflammtion of the small intestine and hemorrhage of the pericardium, the third from an acute inflammation of the crop, oesophagus and gizzard.

The following conclusions are drawn.

1) The observed cases establish the fact that *Agrostemma Githago* has the property of producing in poultry grave symptoms of poisoning.

2) As the meal employed in the experiments contained only 40 to 50 per cent of the grlst of corn cockle seeds, it follows that substitution of one fifth of the daily ration by this grist will cause death.

3) Since the pathological symptoms mentioned above resemble very closely those of acute mineral poisoning, great caution must be employed in judging analogous cases, particularly as siftings of grain containing more or less corn cockle seed constitute a food widely distributed in Hungary.

4) Since the siftings contain widely varying amounts of corncockle seed (from 8 to 38 per cent in the mills of Budapest) the percentage of corncockle seed admissible in the daily ration must be known in order to avoid poisoning.

5) It is convenient to base the daily ration on the maximum content (about 40 per cent) of corncockle seed in the residues from the milling. Nevertheless it is advisable to submit a sample of the product to an Agricultural Station for examination and expert advice.

HORSES

1192 - **Experiments on the Feeding of Draught Horses made in Sweden from 1908 to 1915.** — HANSEN, N. (Director of the Domestic Animal Department of the Central Agricultural Station of Stockholm) in *Fühlings landwirtschaftliche Zeitung*, 65th year, No. 13-14, pp. 289-315. Stuttgart, July 1-15, 1916.

In the years 1908-1915 the Swedish Central Agricultural Experiment Station has made repeated experiments to ascertain the value and practical utility of different foods for draught horses. Some of these experiments have already been described by the writer in a preceding publication. The present experiments 40 in number, divided into 12 series, and made with 372 horses, deal with the following foods : barley, oats, a mixture of oats and barley, maize, potatoe flakes, wheat bran, oat bran, a mixed food (oat bran and rice meal), mangels, carrots and cooked potatoes.

In choosing the animals amongst ordinary draught horses on different farms, care was taken that the horses of the same team were as far as possible of the same age, temperament, and strength and had the same height to the withers. Except one team, all the off-side horses formed one

experimental group, and all the near-side horses another group. In the experiments exact weights of food were distributed to the different groups.

In some series a preliminary experiment was made to ascertain whether the groups were equivalent, but this was unnecessry in most cases, the equivalence of the groups being known beforehand.

The work done by a horse cannot be exactly determined either in agricultural practice or in practical feeding experiments but it can be assumed to be proportional to the nutritive value of the food administered, which is indicated by the change in the live weight of the animals. Consequently the experimental results should be determined from the variations of the live weight of the horses. In order to obtain satisfactory results by means of weighings, all these should be made at the same time of day.

In some experiments the weighing was made regularly at midday, after feeding and before yoking, in others after the return at midday but before feeding. Sufficiently exact results were thus obtained.

The ration was fixed according to the work to be done, in such a manner as to prevent an emaciation of the animals in a period of heavy work, and an increase of weight in a period of light work.

The following results were given by the different foods.

I. *Barley and oats.* — In some previous experiments with cows the writer using KELLNER'S starch value, has estimated the forage value of 100 kgs. of barley at 100 forage units and that of 100 kgs of oats at 84 units. Thus 1 kg. of barley corresponds with about 1.2 kgs of oats.

The present experiments (November 1909 to December 1913) were intended to determine whether this ratio is also true for horses. Barley and oats, of a quality a little inferior to the average were given in a ration of 1 : 1.2. The daily ration contained on an average 4 kgs. (8.8 lbs.). of barley and 5 kgs. (11 lbs.) of oats. There were five experiments lasting from 49 to 77 days, and there were 3 to 8 animals in each group.

The results show that 1 kg. of barley can easily replace 1.2 kg. of oats in the feeding of draught horses. Barley did not prove an unsuitable food for horses, neither did it diminish their working power.

II. *Oats and wheat bran.* — Experiments have shown (in accordance with KELLNER'S observations) that wheat bran is of little value for fattening pigs but an excellent food for milk production.

The writer's experiments were made to determine whether bran had the same effect on horses as on cows, or as on pigs. For this purpose it was considered opportune to compare it with oats. On an average 2.56 kgs. (5.6 lbs.) of oats or 2.78 kgs. (6.1 lbs.) of bran were given. The oats ration contained 2.15 and the bran ration 2.21 forage units. Six experiments were made lasting 28 to 69 days, and there were three to eight animals in each group.

The wheat bran, which is richer in forage units, also produced a rather greater increase in the live weight of the animals, from which the conclusion is drawn that the action of bran on horses is similar to that on cows.

III. *Oats and maize.* — The forage values of oats and maize were to be compared, and for this purpose they were employed in the ratio of

1.2 : 1.0. The oats were of excellent quality, but the maize scarcely up to the average. 3.67 forage units of maize were replaced by 3.75 units of oats. The maize ration contained on an average 3.6 kgs. (7.9 lbs.) and the oats ration 4.3 kgs. (9.5 lbs.) per head per day. There were six horses and two experiments lasting 49 to 77 days.

From the results it is concluded that if the maize ration does not exceed 50 per cent of the total ration of concentrated food, and if the maize is finely ground before being given to the horses its forage value is 20 per cent higher than that of oats. Thus oats can be replaced by maize in the proportion of 1.2 : 1.0.

IV. *Oat bran and a mixture of oats and barley.* — From the oat mills of Sweden a bran is obtained which before the War was largely exported. Export now being forbidden, this has to be utilised in the country, and it is of interest to learn its forage value. Previous experiments made with cows proved that 1 kg. of oats bran is equivalent to 1 forage unit.

The writer's experiments were intended to determined whether this bran is as valuable for horses as for cows. A mixture of barley and oats was employed as a standard of comparison. The four experiments lasted 55 to 90 days each and were made on 17 horses each receiving up to 3 kg. (6.6 lbs.) of oat bran per day. The experiments showed that when 1 kg. (2.2 lbs.) of the mixture was replaced by 1.42 kgs. (3.1 lbs.) of bran, the latter did not give the expected result, but if the ratio was smaller a better result was obtained. For the group fed with oat bran a better mean experimental result was obtained than for the group fed with the mixture, and it may be concluded that in practice 1.8 kg. (4 lbs.) of oat bran is equivalent to 1 forage unit. Oat bran is not a better food for horses than for cows Not more than 4 kgs. (8.8 lbs.) per head per day should be given.

V. *Mixture of barley and oats, and the mixed food " Gota ".* — The low, forage value of oat bran together with its high content of raw cellulose have induced the manufacturers to improve its quality by the addition of rice meal. This mixed food (60 per cent oat bran and 40 per cent rice meal) This is sold in Sweden under the name of " Gota ". Feeding experiments made with cows and pigs have shown that 1.5 kgs. (3.3 lbs.) of Gota is almost equivalent to 1 kg. (2.2 lbs.) of barley or 1.1 kgs. (2.4 lbs.) of the mixture of oats and barley.

In the experiments with horses 1.5 kgs. (3.3 lbs.) of Gota were replaced by 1.1 kgs. (2.4 lbs.) of the mixture of barley and oats. Two experiments were made lasting from 82 to 84 days ; eight horses were employed to which a ration of 3.85 kgs. (8.5 lbs.) of Gota was given per head per day.

Somewhat the better results were obtained with the group which had been fed with Gota, but in general the two forages can be described as equivalent. According to the writer, Gota is an excellent food for horses, but it must be of good quality and must not contain more than 16 per cent of raw cellulose.

VI. *Barley and potato flakes.* — The experiment was made to determine the forage value of these two materials for horses. Two kgs. (4.4 lbs.) of barley were first replaced with 2 kgs. (4.4 lbs.) of flakes, then with 2.5 kgs.

(5.5 lbs.). Two experiments were made lasting 78 and 43 days, and the total number of horses employed was nine.

The final result was in favour of the potato flakes, and it is concluded that for feeding horses 1 kg. (2.2 lbs.) of flakes containing 980 grms. (1.9 lbs.) of dry matter will easily replace 1 kg. of ordinary barley.

VII. *Barley and cooked potatoes.* — The writer has shown experimentally that in the fattening of pigs 1 kg. (2.2 lbs) of ordinary barley can be replaced by 0.9 kg. (2 lbs.) of the dry matter of cooked potatoes.

In the experiment with horses the two forages were given in the above proportion. The potatoes were cooked every three days and at least four rations of them were given daily. Except in one case all the eight horses ate these rations willingly. Two experiments were made lasting 71 to 80 days, and the daily ration contained 2 to 3 kgs. (4.4 to 6.6 lbs.) of dry matter.

The two groups gave the same result. Accordingly the conclusion is drawn that in the feeding of horses a ration of 900 grms. (2 lbs.) of the dry matter of potatoes has the same forage value as 1 kg. (2.2 lb.) of barley.

VIII. *Mixture of oats and barley and mangels.* — This mixture was replaced partly by mangels and partly by carrots in the proportion 1 kg. Mixture : 1 kg dry matter of the roots 8 to 20 kgs. (17.6 to 44 lbs.) of roots were fed per head per day. Four experiments were made with 17 horses, lasting 50 to 89 days.

The experiments proved that well cleaned roots can be given at the rate of 20 kgs (44 lbs ) per head per day without injury to the horses. 1 kg (2.2 lbs.) of the dry matter of the roots has the same nutritive value as 1 kg. (2.2 lbs.) of the mixture.

The experiments were intended also to discover the quantity of food required by horses. The quantity of forage administered was determined daily, and then from measurements of the live weight of the horse, it was determined whether the ration was suitable for the work to be done. The nutritive value of the different rations was expressed in forage units. In addition the content of digestible protein in each ration was determined.

The results show that the number of forage units and the necessary quantity of digestible protein vary according to the work done by the horses. All the experiments have proved however that the ration is completely utilised if it contains 75 to 80 grms of digestible protein per forage unit. This, the writer terms " the minimum requirement " of digestible protein

Based on these observations the following relative figures have been established for horses weighing about 600 kgs. (12 cwt.).

| Kind of work done by the horses. | Number of forage units required | Quantity of digestible protein required |
|---|---|---|
| Light | 7 to 8 | 500 to 600 gms. |
| Medium | 8 to 10 | 600 to 800 gms. |
| Heavy | 10 to 12 | 800 to 1000 gms. |
| Very heavy | more than 12 | more than 1000 gms. |

CATTLE

1193 – **Score for Holstein-Friesian Bulls and Cows Adopted by the Holstein-Friesian Association of America.** — BENNET, E. G., in *Missouri State, Board of Agriculture, Monthly Bulletin*, Vol. XIII, No. 11, pp. 57-61, Columbia Mo. November 1915.

The Holstein-Friesian Association of America (1) has adopted the following scale of points for the score of Holstein-Friesian Bulls and cows:

## SCORE FOR HOLSTEIN-FRIESIAN BULL.

(The text under each heading relates entirely to the method of application agreed upon by the Inspectors in order to secure uniformity of work. The abbreviations are as follows vs, very slight; s, slight; m, marked; vm, very marked; e, extreme).

| | Contents |
|---|---|
| HEAD. — Showing full vigor; elegant in contour<br>*Discredit*: *vs* 1/8 — *s* 1/4 — *m* 1/2, — *vs* 3/4 — *e* 1. | 2 |
| FOREHEAD. — Broad between the eyes; dishing<br>*Discredit*: *vs* 1/8 — *s* 1/4 — *m* 1/2 — *vm* 3/4 — *e* 1. | 2 |
| FACE. — Of medium length; clean and trim, especially under the eyes; the bridge of the nose straight<br>*Discredit*: *s* 1/8 — *m* 1/4 — *e* 1/2. | 2 |
| MUZZLE. — Broad with strong lips<br>*Discredit*: *s* 1/8 — *m* 1/4 — *e* 1/2. | 1 |
| EARS. — Of medium size; of fine texture; the hair plentiful and soft; the secretions oily and abundant.<br>*Discredit*: *m* 1/8 — *e* 1/4. | 1 |
| EYES. — Large; full; mild; bright<br>*Discredit*: *s* 1/8 — *m* 1/4 — *e* 1/2. | 2 |
| HORNS. — Short; of medium size at base; gradually diminishing towards tips, oval; inclining forward; moderately curved inward; of fine texture; in appearance waxy<br>*Discredit*: *m* 1/8 — *e* 1/4. | 1 |
| NECK. — Long; finely crested (if the animal is mature); fine and clean at juncture with the head; nearly free from dewlap; strongly and smoothly joined to shoulders<br>*Dicredit*: *vs* 1/8 — *s* 1/4 — *m* 1/2 — *vm* 3/4 — *e* 1. | 5 |
| SHOULDERS. — Of medium height; of medium thickness, and smoothly rounded at tops; broad and full at sides: smooth over front<br>*Discredit*: *vs* 1/2 — *s* 1/4 — *m* 1/2 — *vm* 2/4 — *e* 1. | 4 |
| CHEST. — Deep and low; well filled and smooth in the brisket; broad between the forearms; full in the foreflanks (or through at the heart)<br>*Discredit*: *vs* 1/4 — *s* 1/2 — *m* 1 — *vm* 1 1/2 — *e* 2. | 7 |
| CROPS. — Comparatively full; nearly level with the shoulders<br>*Discredit*: *vs* 1/4 — *s* 1/2 — *m* 1 — *vm* 1 1/2 — *e* 2. | 4 |
| CHINE. — Strong; straight, broadly developed, with open vertebrae.<br>*Discredit*: *vs* 1/8 — *s* 1/4 — *m* 1/2 — *vm* 3/4 — *e* 1. | 6 |
| BARREL. — Long; well rounded; with large abdomen; strongly and trimly held up<br>*Discredit*: *vs* 1/4 — *s* 1/2 — *m* 1 — *vm* 1 1/2 — *e* 2. | 7 |
| LOIN AND HIPS. — Broad; level or nearly level between hook-bones; level and strong laterally; spreading out from the chine broadly and nearly level; the hook-bones fairly prominent<br>*Discredit*: *vs* 1/8 — *s* 1/4 — *m* 1/2 — *vm* 3/4 — *e* 1. | 7 |

(1) Gardner M. H. Superintendent. Delavan, Wisconsin.

Contents

RUMP. — Long; broad; high; nearly level laterally; comparatively full above the thurl; carried out straight to dropping of tail . . . . . 7
*Discredit: vs* 1/8 — *s* ¼ — *m* ½ — *sm* 3/4 — *e* 1.

THURL. — High; broad . . . . . 4
*Discredit: vs* ¼ — *s* ½ — *m* 1 — *vm* 1 ½ — *e* 2.

QUARTERS. — Deep; broad; straight behind; wide and full at sides; open in the twist . . . . . 5
*Discredit: vs* 1/8 — *s* ½ — *vm* 3/4 — *e* 1.

FLANKS. — Deep; full . . . . . 2
*Discredit: vs* 1/8; *s* ¼; *m* 1/2; *v m* 3/4; *e* 1.

LEGS. — Comparatively short; clean and nearly straight; wide apart; firmly and squarely set under the body; arms wide, strong and tapering; feet of medium size, round, solid and deep . . . . . 5
*Discredit: vs* 1/8 — *s* ¼ — *m* 1/2 — *vm* 3/4 — *e* 1.

TAIL — Large at base, the setting well back; tapering finely to switch; the end of bone reaching to hocks or below; the switch full . . . . . 2
*Discredit: s* 1/8 — *m* ¼ — *e* ½.

HAIR AND HANDLING. — Hair healthful in appearance; fine, soft and furry; skin of of medium thickness and loose; mellow under the hand; the secretions oily, abundant and of a rich brown or yellow color . . . . . 10
*Discredit: vs* ¼ — *s* ½ — *m* 1 — *vm* 1 ½ — *e* 2.

MAMMARY VEINS. — Large; full; entering large orifices; double extension; with special development, such as forks, branches, connections, etc . . . . . 10
*Discredit: vs* ¼ — *s* ½ — *m* 1 — *vm* 1 1/2 — *e* 2.

RUDIMENTARY TEATS. — Large, well placed . . . . . 2
*Discredit: vs* 1/8 — *s* ¼ — *m* ½ — *vm* 3/4 — *e* 1.

ESCUTCHEON. — Largest; finest . . . . . 2
*Discredit: vs* ½ — *s* 1 — *m* 2 — *vm* 3 — *e* 4.

* GENERAL VIGOR. — For deficiency Inspectors shall discredit from the total received not to exceed eight points.
*Discredit: vs* 1 — *s* 2 — *m* 3 — *vm* 5 — *e* 8.

* GENERAL SYMMETRY AND FINENESS. — For deficiency Inspectors shall discredit from the total received not to exceed eight points
*Discredit: vs* 1 — *s* 2 — *m* 3 — *vm* 5 — *e* 8.

* GENERAL STYLE AND BEARING — For deficiency Inspectors shall discredit from the total received not to exceed eight points.
*Discredit: vs* 1 — *s* 2 — *m* 3 — *vm* 5 — *e* 8.

* CREDITS FOR OFFSPRING. — A bull shall be credited one point in excess of what he is otherwise entitled to, for each and every animal of which he is sire actually entered in the Advanced Register, not to exceed ten in number

* In scaling for the Advanced Register, defects caused solely by age, or by accident, or by disease not hereditary, shall not be considered. But in scaling for the show ring, such defects shall be considered and duly discredited

* A bull that in the judgment of the Inspector will not reach, at full age and in good flesh, 1,800 lbs., live weight, shall be disqualified for entry in the Advanced Register

* No bull shall be received to the Advanced Register, that with all credits due him, will not scale, in the judgment of the Inspector, at least 80 points.

Perfection . . . . . 100
Total discredit . . . . . .....

Net score. . . . . .....

* Not now in use by Advanced Register, but of great value as an aid in judging cattle.

## Score for Holstein-Friesian cow.

(The interlines relate entirely to the method of application agreed upon by the Inspectors in order to secure uniformity of work. The abbreviations are as follows: vs, very, slight; s, slight; m, marked; vm, very marked; e extreme.)

Contents

HEAD. — Decidedly feminine in appearance; fine in contour . . . . . 2
*Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.*

FOREHEAD. — Broad between the eyes; dishing . . . . . 2
*Discredit; vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.*

FACE. — Of medium length; clean and trim especially under the eyes, showing facial veins; the bridge of the nose straight . . . . . 2
*Discredit: s 1/8 — m 1/4 — e 1/2.*

MUZZLE. — Broad with strong lips. . . . . 1
*Discredit: s 1/8 — m 1/4 — e 1/2.*

EARS. — Of medium size; of fine texture; the hair plentiful and soft; the secretions oily and abundant . . . . . 1
*Discredit: m 1/8 — e 1/4.*

EYES. — Large; full; mild; bright . . . . . 2
*Discredit: s 1/8 — m 1/4 — e 1/2.*

HORNS. — Small; tapering finely towards the tips; set moderately narrow at base; oval; inclining forward; well bent inward; of fine texture; in appearance waxy . . . . . 1
*Discredit: m 1/8 — e 1/4.*

NECK. — Long; fine and clean at juncture with the head; free from dewlap; evenly and smoothly joined to shoulders . . . . . 4
*Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.*

SHOULDERS. — Slightly lower than the hips; fine and even over tops; moderately broad and full at sides . . . . . 3
*Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.*

CHEST. — Of moderate depth and lowness; smooth and moderately full in the brisket; full in the foreflanks (or through the heart) . . . . . 6
*Discredit: vs 1/4 — s 1/2 — m 1 — vm 1 1/2 — e 2.*

CROPS. — Moderately full . . . . . 2
*Discredit: vs 1/4 — s 1/2 — m 3/4 — vm 1 1/2 — e 2.*

CHINE. — Straight; strong; broadly developed, with open vertebrae . . . . . 6
*Discredit, vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.*

BARREL. — Long; of wedge shape; well rounded; with a large abdomen, trimly held up (in judging the last item age must be considered) . . . . . 7
*Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.*

LOIN AND HIPS. — Broad; level or nearly level between the hook-bones; level and strong laterally; spreading from chine broadly and nearly level; hook-bones fairly prominent . . . . . 6
*Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.*

RUMP. — Long; high; broad with roomy pelvis; nearly level laterally; comparatively full above the thurl; carried out straight to dropping of tail . . . . . 6
*Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.*

THURL. — High; broad . . . . . 3
*Discredit: vs 1/4 — s 1/2 — m 1 — vm 1 1/2 — e 2.*

QUARTERS. — Deep; straight behind; twist filled with development of udder; wide and moderately full at the sides . . . . . 4
*Discredit: vs 1/8 — s 1/4 — m 1/2 — vm 3/4 — e 1.*

Contents

FLANKS. — Deep; comparatively full . . . . . 2
*Discredit*: *vs* 1/8 — *s* ¼ — *m* ½ — *vm* 3/4 — *e* 1.

LEGS. — Comparatively short; clean and nearly straight; wide apart; firmly and squarely set under the body; feet of medium size, round, solid and deep . . 4
*Discredit*: *vs* 1/8 — *s* ¼ — *m* ½ — *vm* 3/4 — *e* 1.

TAIL. — Large at base, the setting well back; tapering finely to switch the end of the bone reaching the hocks or below; the switch full. . . . . 2
*Discredit*: *s* 1/8 — *m* ¼ — *e* ½.

HAIR AND HANDLING. — Hair healthful in appearance; fine, soft and furry; the skin of medium thickness and loose; mellow under the hand; the secretions oily, abundant and of rich brown or yellow colour . . . . . 82
*Discredit*: *sv* ¼ — *s* ½ — *m* 1 — *vm* 1 ½ — *e* 2.

MAMMARY VEINS. — Very large; very crooked (age must be taken into consideration in judging of size and crookedness); entering very large or numerous orifices; double extension; with special developments, such as branches, connections, etc. . . . . 10
*Discredit*: *vs* ¼ — *s* ½ — *m* 1 — *vm* 1 ½ — *e* 2.

UDDER. — Very capacious; very flexible; quarters even; nearly filling the space in in the rear below the twist, extending well forward in the front; broad and well held up . . . . . 12
*Discredit*: *vs* ¼ — *s* ½ — *m* 1 — *vm* 1 ½ — *e* 2.

TEATS. — Well formed; wide apart, plumb and of convenient size . . . . . 2
*Discredit*: *vs* ¼ — *s* ½ — *m* 1 — *vm* 1 ½ — *e* 2.

ESCUTCHEON. — Largest; finest . . . . . 2
*Discredit*: *vs* ½ — *s* 1 — *m* 2 — *vm* 3 — *e* 4.

* GENERAL VIGOR. — For deficiency Inspector shall discredit from the total received not to exceed eight points.
*Discredit*: *vs* 1 — *s* 2 — *m* 3 — *vm* 5 — *e* 8.

* GENERAL SYMMETRY AND FINENESS. — For deficiency Inspector shall discredit from the total received not to exced aight points.
*Discredit*: *vs* 1 — *s* 2 — *m* 3 — *vm* 5 — *e* 9.

* GENERAL STYLE AND BEARING. — For deficience Inspectors shall discredit from the total received not to exceed eight points.
*Discredit*: *vs* 1 — *s* 2 — *vm* 3 — *m* 5 — *e* 8.

* Credits for Excess of Requirement in Production. — A cow shall be credited one point in excess of what she is otherwise entitled to, for each and every eight per cent that her milk or butter record exceeds the minimum requirement.

* In scaling for the Advanced Register, defects cause solely by age, or by accident or by disease not hereditary, shall not be considered. But in scaling for the show ring, such defects shall be considered and duly discredited.

* A cow that in the judgment of the Inspector will not reach at full age, in milking condition and ordinary flesh, 1,000 lbs weight, shall be disqualified for entry in the Advanced Register

* No cow shall be received to the Advanced Register that, with all credits due her, will not scale, in the judgment of the Inspector, at least 75 points. (See in last paragraph of Rule VI an exception to these requirements.).

Perfection . . . . . 100
Total discredit . . . . . .....
Net score . . . . . .....

* Not now in use by Advanced Register, but of great value as an aid in judging cattle.

1194 – **Score Cards for Simmenthal Cattle.** — See this *Bulletin*, No. 1158.

1195 – **Establishment of a Herd-Book for the Caracu Breed of Brazil.** — *A Estancia*, 4th Year, No. 5, pp. 147-149. Porto Alegre, May 1916.

A society has been founded for the Brazilian Caracu Cattle (1) in the State of São-Paulo, Brazil, under the patronage of the Ministry of Agriculture. It is open to all breeders living in the State of São-Paulo.

In the Caracu Herd-Book can be entered.

1) Pure bred animals, intended for breeding, belonging to a member, and having been passed by the Committee of Registration.

2) Offspring of parents already entered.

Such animals are registered only provisionally. They will be definitely entered only they have reached the prescribed age and then only after a fresh examination.

The registrations are free. The Commission of Registration nominated by the Society, will visit the farms of members twice a year in order to examine pure bred animals for registration in the Caracu Herd-Book. The Commission is composed of two live-stock experts of the Ministry of Agriculture, an official veterinary surgeon and three practical breeders elected from amongst the members.

Members must communicate the birth of calves from pedigree animals not more than two months after calving ; when pedigree animals change hands the names of buyer and seller must be given. The death of registered animals must be notified.

For every registered animal a certified pedigree may be obtained signed by the president and secretary of the Society and endorsed by the Ministry of Agriculture of the State of São-Paulo. All the animals definitely registered in the Caracu Herd-Book must bear the mark of the Society and their respective numbers.

A revised edition of the herd-book will be published every year by the Society.

1196 – **Dairying on the River Murray Areas.** — Lane, G., in *The Journal of Agriculture of South Australia*, Vol. XIX, No. 12, pp. 1043-1046. Adelaide, July 1916.

In a paper read before the Conference of River Murray Branches of the Agricultural Bureau on the development of milk production in the arid and irrigated parts of this region, the writer deals fully with the problem of the production of forage in the summer months and emphasises the importance of ensilage in the feeding of dairy cattle.

According to the writer it is only by the preservation of forage in the silo that milk production can be successfully undertaken on farms deprived of irrigation. Otherwise the advantages to be obtained during the period of the year when green forage is available are nullified by the losses to which agriculture is exposed in the dry months, when the production of forage is impossible without irrigation. Milk production in areas which are semiarid or where the rains are irregular, must henceforward be considered as closely

(1) See *R.* October 1916, No. 1093.

connected with the ensilage of the forage, and the silo would lend a strong support and a factor of success to cattle and sheep breeding in these areas.

The overhead silo, cylindrical and built of stone or lime-concrete gives the best results. Maize and sorghum are the silage crops most employed; but oats, barley and wheat also give good results, if care is taken to ensile them as soon as they are reaped at the beginning of the ripening of the grain. The good results obtained with the Jersey breed of cows is described, and the crossing of typical milking strain Jersey bulls with Ayrshire and Shorthorn cows is recommended. The average production of the writer's herd was well over 6,300 lbs. of milk per cow for eight months. The writer does not consider that machine milking has sufficient advantage over hand milking to give it the preference. It is a mistake to give calves skim milk too soon. When the mother's milk is discontinued the calf should receive at first half ordinary and half separated milk. To ensure success either in milk or butter selling, the animal heat should be got out of the fluid at the earliest possible moment.

1197 – **Mendelism of Short Ears in Sheep.** — RITZMAN E. G., in *Journal of Agricultura Research*, Vol. VI, No. 20, pp. 797-798. Washington, D. C., August 14, 1916. SHEEP

The ordinary ear lengths of the various breeds of sheep approximate very closely to 10 cm. (4 inches) or a little over. On the other hand the longest of the "short ears" so far observed in a mature animal measure 7 cm. (2 3/4 inches), and they are somewhat thicker than ordinary type of ear. The transmissibility of this feature has been studied by the writer at the New Hampshire Agricultural Experiment Station, United States, in the case of one native ewe and her progeny, which number 15 head, and by Dr C. B. DAVENPORT of the Station for Experimental Evolution, of the Carnegie Institute, who bred two short ear animals supplied by the writer.

The results show in a uniform and concordant way that the "short ear" trait constitutes a simple Mendelism unit factor.

1198 – **The Travelling of Flocks in the Dinaric Zone (Eastern Adriatic).** — DEDIJER J., in *Annales de Géographie*, Year XXV, No. 137, pp. 347-365. Paris, September 15, 1916.

The annual travelling of flocks and herds to upland summer grazing is quite distinct from other forms of pastoral migrations such as is practised by the nomads of the steppes. Travelling shepherds unlike the nomads are really attached to the soil, not only in their lowland villages but also in the mountain pastures which they visit periodically. This summer migration finds its true home in the Mediterranean region for besides being usual amongst the primitive peoples of the Caucasus, Asia Minor and North Africa, it is practises by the most highly civilized European nations, and is a standing proof that analogous geographical factors entail analogous social developments. Working from Belgrade, the writer has spent several years studying the migrations in the mountain system running down the eastern side of the Adriatic in order to determine how far the custom is modified by the physical character of the surface.

Three forms of pastoral life are distinguished: 1) the travelling flocks

of the coast ; 2) the non-migrating flocks of the Mid-dinaric zone, and 3) the migrating flocks of the Pannonian Plain. These three groups correspond to the three divisions of the region brought about by the position of the mountain range which runs from north west to south east. On the Adriatic side the country shows all the signs of the Mediterranean influence in climate, flora and fauna ; but on the Pannonian Plain which is on the northern and north eastern side of the ridge, the climate, flora and fauna of Central Europe prevail. Between these two zones lies the region of high mountains where conditions of life have arisen somewhat similar to those found in Alpine regions.

I. *The travelling of flocks in the Adriatic zone.* — Between the coast and the watershed 3 regions are distinguished : 1) the low region, reaching up to 800 to 2500 ft. in its highest parts, occupied by the villages of the people who undertake the summer migrations, 2) the intermediate zone where stock raising is practised without migrations ; 3) the zone of summer pastures on the high mountains, occupied intermittently. Migrations begin early in June. In the low region the drought is severe and the population labour incessantly to increase the water supply. With infinite trouble too, they reclaim and cultivate small isolated pieces of land, going so far in some places as to gather manure in the village streets to place in the crevices of rocks and then planting vines therein. In other places they build walls across the dry beds of torrents so that in the rainy season a sediment should be deposed ; by persevering for 30 years, one man has obtained a field yielding 2 tons of maize by such means.

Where a suitable hill adjoins the village, lambing stations are often established at altitudes of 1500 to 2500 ft. to which the flocks are brought from the high mountain for the winter season, but if there is no convenient hill of that kind then the flocks are brought right down to the villages. Where the neighbouring foothills reach an altitude of over 4000 ft. then the flocks do not need to migrate to the high mountains for summer pasture.

In the region of Duvno (western Herzegovina) the migrations depend on the water table. During exceptional droughts, it may occur that shepherds who have returned home from the high mountain in early autumn have to take their flocks back to higher altitudes for water. On some routes, such as those from the arid Karst region, there are regular halting places where the shepherds remain for some time.

A more primitive form of migration exists in some parts where the entire population leaves the villages for six months of the year and accompanies the flocks to the high mountains. In other parts where the land is more fertile, tillage has largely replaced stock raising and migrations have been abandoned on account of the small size of the flocks.

II. *The non-migrating flocks of the Mid-dinaric zone.* — This zone consists of a high region (above 2300 ft. on the Adriatic side) where the rainfall is well distributed throughout the year and the summer heat never excessive. Local migrations only take place from the deep river valleys which even in those altitudes are unbearably hot in summer. Being very narrow the cultivated surface is very restricted and further it is planted in fruit

trees, so that the summer pasturing of livestock is a difficult matter. The herds are consequently sent to the neighbouring mountain sides.

III. *The migrating flocks of the Pannonian zone.* — On the north eastern side of the ridge the migrations are in the opposite direction, *i. e.* from mountain villages to lowland pastures, and take place twice a year, in autumn and in spring. Whereas the migrations on the Adriatic side are undertaken on account of heat and drought, the flocks on the Pannonian side are driven to the mountains by snow and excessive cold. In the autumn, flocks of 800 to 1000 sheep come down to the plain for pasture and when the first snow occurs return to the mountain where they winter in barns. Then in spring they come down again for what is known as the " lambing migration ".

1199 – **A Model Poultry Farm in Uruguay.** — *El Estanciero*, 6th Year No. 137, pp. 9-11. Montevideo, June 15, 1916. POULTRY

The most important poultry farm in Uruguay is situated close to the station of Toledo. It was established in 1913 by the Government with a total head of 350 birds, comprising 200 Leghorn fowls obtained from the United States, 100 Prat Catalonians of Spanish origin, groups of three fowls each of the breeds White Plymouth Rock, Bastard Plymouth Rock, Buff Orpington, Faverolles Wyandotte (simple comb and rose comb), and Minorca, and 20 ducks of the Pekin breed.

In 1915 the farm produced 39 877 eggs. Of these 6240 were given to farmers for breeding, 8000 were sold for consumption and the farm set the remainder obtaining 9873 chickens and 200 ducklings of the Pekin breed. In the same year 5000 fowls were sold. A head of 300 fowls and 300 ducks now maintained on the farm.

The farm is provided with the most up to date plant. It can breed 3000 chickens per annum and its 20 incubators have a capacity of 4800 eggs. The chickens are kept shut up for one month ; they are then transferred to a special rearing house, and from there to large enclosures. By far the largest proportion though are sold immediately they are hatched. In order to avoid all possibility of contagion, water is distributed from a tank to all enclosures and poultry houses in such a way that no two chickens can drink from the same place. A 5 HP oil engine is used for a pump and for driving the other mechanical devices required by the farm.

The administration of the farm is entrusted to a manager and an assistant who work under general directions from a committee.

1200 – **The " Ideal " Crespi-Balbi Hive.** — *L'Agricoltore moderno*, Year III, No. 8, pp. 131-133. Turin, August 1916. BEE-KEEPING

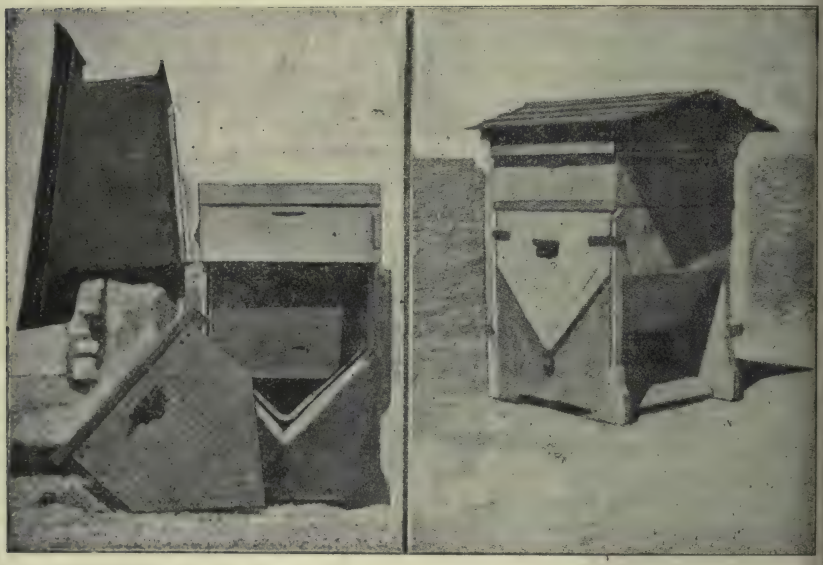
The International Museum of Agriculture at Turin has received and reported on a new hive, the " Ideal ", sent by its inventor Mr C. Crespi-Balbi of Busto Arsizio (Italy). It is an improvement on the type originally introduced by Pettitt in England and by Tonelli in Italy, and combines the good qualities of the American and German hives.

In the Pettitt-Tonelli type the moveable frames have curved sides while in the new type the sides are straight and in the form of a pentagon.

Two very fine wires which also serve to attach the comb foundations bind each frame together with great rigidity. Though the frames are placed longitudinally in the hive draughts are prevented by having the entrance at the bottom and right in the middle. The frame of the supers is only 5 in. high, the better to prevent the queen from going up into it.

When it is required to examine the hive, the top may be lifted off if the weather be warm enough, otherwise one or other of the side walls may be removed. By this means only half the sections are uncovered at any one moment and for a much shorter time than is possible with the German

*The "Ideal"* CRESPI-BALBI *hive.*



In sections Ready for use.

hives. For casual examinations the mirror placed in the rear wall is use When necessary the bees may be fed through a hole in the front wall.

The walls of the hive are nearly 1 ¼ in. thick and give ample protectic against temperature changes; it has been shown in Lombardy that th increase in yield obtained in hives with cavity walls is not sufficient to com pensate for the increased cost of the hive.

A new feeder has also been put on the market by Mr Crespi-Balb It is a combination of the Guzzi type with Root's "Simplex".

1201 – **Ontario Beekeepers Association Honey Crop Report for 1916** *in The Canadian Horticulturist and Beekeeper*, Vol. 24, N°. 9, p. 225. Peterboro, Ont. September 1916.

The White Honey Crop in 50 counties of Ontario, in 1916, according to the Ontario Beekeepers' Association, was 2 127 903 pounds, from 23 763 colonies (spring count) with an average of 89,6 pounds per colony. The honey crop in 1915 was 1 175 871 pounds from 20 402 colonies.

1202 – **The Work of the Institute for Research on Silkworms at Portici (Italy).** — Acqua C., *Rendiconti dell'Instituto bacologico della R. Scuola superiore di Agricoltura in Portici*, Vol. I, pp. 1-98. Portici, 1916. SERICULTURE

I. *Experiments on the digestion of silkworms.* — In order to investigate the digestibility of proteins, fats and carbohydrates by silkworms a quantity of intestinal juice was extracted from worms under normal conditions of rearing and its effect on the various substances was studied *in vitro*. The presence of an active protease was proved. This ferment works in an alcaline medium and must be considered of the nature of a trypsin, acting on blood fibrin and on egg albumen either in the liquid or coagulated form. Starch and fats were untouched and this was confirmed by microchemical tests carried out on pieces of ingested mulberry leaf which were removed from various parts of the intestinal tract. On the other hand, as soluble sugars which are contained in considerable quantities by the leaf were digested, the starch in the leaf must be absorbed indirectly. The cell membranes of ingested leaves remained absolutely unaltered, so that absorption of protein substances from the cytoplasm could only take place after the rupture of the cell walls. With regard to the chlorophyll, it would seem certain that where the tissue was disintegrated the pigment contained in the chloroleucites was absorbed, but where the chloroleucites remained enclosed inside the cells, the pigment remained unaltered. This fact was confirmed by a spectroscopic test. The secretions from the anterior and middle portions of the intestine were precisely similar in their effect, but the secretion from the posterior part of the intestinal tract was absolutely inactive.

II. *Phototaxy in silkworms* (1).

III. *Experiments on the absorption of glucose by stems and leaves of mulberry trees.* — In a previous paper (2) a description has already been given of the methods adopted for obtaining the absorption of liquids by the aerial parts of plants. It consists in cutting through the petioles near the blade of the leaf or cutting the tips of young shoots and placing the cut surfaces in the solution to be tried. The method was applied to *Morus alba*, using a solution of 5 per cent glucose for the cut ends of young shoots or a solution of 6 to 10 per cent applied in a glass tube to a wound made in the trunk of the tree. Where the experimental plants were very young, the glucose absorbed had a very marked effect : growth was increased ; the shoots were longer and thinner and much less rigid so that they required support ; the leaves were larger and thinner showing a considerable reduction of the palissade and spongy tissues. With the medium-sized plants the growth was

(1) See *R.* March 1916, No. 328. (*Ed.*)

(2) *Rendiconti dell'Accademia dei Lincei*, Vol. XXIII, 1913.

still affected but to a less degree an dwith adult trees, the differences obtained were very small. A microscopic examination revealed equal quantities of starch in the leaves of the test plants and of the control plants, and Fehling's solution showed no accumulation of glucose in the treated leaves, so that it may be concluded that the absorbed solution was used up in the development of the plant.

IV. *An electric bell for giving warning of changes of temperature during incubation.* — The writer has invented a new instrument to ensure a constant temperature during incubation. It is sensitive to half a degree C., is simple and inexpensive, and may be obtained from CAROSI, Rome for 2 lire.

V. *Autumn rearing of silkworms.* — Autumn rearing as a whole has not proved a success chiefly owing to the imperfect preparation of the *graine*. The stripping of mulberry trees in autumn, if properly carried out, need entail none but the very slightest injury to the trees, and where the trees are abundant the supply of leaves should offer no difficulty.

Some of the methods of obtaining *graine* for autumn hatching are to be condemned, *i. e.* the use of eggs from the previous season or from a very early spring hatching after storage at low temperature during the summer. Other methods yield worms of doubtful vigour, as for instance the Quajat method where the *graine* is prepared in October, estivates during the winter, and hibernates during the summer. Occasionally the use of retarded eggs has been recommended before they have been tested thoroughly under practical conditions (*e. g.* the retardation of spring eggs by means of electricity, acids, etc.). The best method is undoubtedly that of Dr CRIVELLI; it is known as the « embryostatic » method, and has given excellent results in practice over a number of years. Details of the management have been kept secret, but in general outline they must resemble that of MARTINI (given below) as both yield identical results

*Management of silkworms under the Martini system.*

| | Temperature at which the silkworms must be maintained °C. |
|---|---|
| *Period of estivation*: | |
| From laying time to end of August | 22 to 27 |
| During September | 20 " 22 |
| " October | 17 " 20 |
| From November to end of February | 16 " 17 |
| " March 1 to 20 | 8 " 10 |
| *Period of hibernation*: | |
| From March 20 to July 30 | 2 " 3 |
| " August 1 to about August 15 when incubation begins | gradual rise |

The writer states that 20 years ago he had the opportunity of seeing some extensive rearings carried out with *graine* supplied by Dr Crivelli and even tested the eggs himself. In every case most satisfactory results were obtained. Autumn rearing had become popularized to the point of being a matter of current practice in parts of Central Italy, but with the spread

of the practice, the sale of unreliable *graine* became common and led finally to a season of complete and general failure after which autumn rearing fell into disrepute and was abandoned.

1203 – **The Work of the Experiment Station for Silk Worms at Murcia, Spain, 1910 to 1914.** — VIRGILI A., in *Ministerio de Fomento, Dirección general de Agricultura, Minas y Montes, Estación sericola di Murcia, Memoria descriptiva de los principales trabajos realizados y resultados obtenidos desde 1º de Diciembre de 1910 hasta el 15 Enero de 1914, traslado de la estación y aplicación de los servicios*, pp. 1-100. Murcia, 1915.

1) *Variety Trials.* During the three years 1911 to 1913, 210 gms. of *graine* was obtained from Italy, France, Japan, China and other Spanish provinces and tested at Murcia; the more suitable varieties were then selected and acclimatised for subsequent distribution to rearers. Some Italian varieties proved particularly successful, being heavier yielders than the native varieties and producing a silk which finds a ready market both in Spain and at Marseilles. They have not, however, reached the stage of distribution as they are not yet fully acclimatised.

2) *Incubation of graine for rearers; inspection of home incubation.* — A new State service was instituted 1913 to revise and bring up to date the old fashioned systems of incubation practised in the district. A new incubator of 120 oz. capacity was invented and built by the Station for its own use, while 35 small 10 oz. machines and a number of Orlandi incubators (80 oz.) were lent to rearers in the neighbourhood. The cost of the small incubators (10 oz.) was 17.5 pesatas (14*s*) and the heating arrangement for each would come to another 2 pesetas. Full instructions for working were supplied with each incubator. Inspectors from the Station also visited 135 farms where 314 oz. of *graine* were being dealt with, and at the Station itself the incubation of 123 oz. was carried out for 128 rearers.

3) *Microscopical examination of silkworms and their eggs.* — Rearers were invited to have their *eggs* tested for *pebrine* and a considerable amount of this kind of work was carried out (Table I). At the same time a

TABLE I. — *Results of the microscopic examination of silk-worm eggs.*

| Years | Silk-worm eggs produced by private person | | | Silk-worm eggs produced by the Station | | |
|---|---|---|---|---|---|---|
| | Number of specimens | Number of cells | Average per cent of infection | Number of specimens | Number of cells | Average per cent of infection |
| 1911 . . . . . | 177 | 21 916 | 8.57 % | 38 | 6 915 | 10.90 % |
| 1912 . . . . . | 237 | 37 105 | 6.43 | 55 | 13 075 | 6.60 |
| 1913 . . . . . | 930 | 108 692 | 20.94 | 87 | 24 172 | 22.05 |

free course of instruction was offered to rearers on the technique of examination and the provincial council awarded a microscope as a prize to all those who became thoroughly proficient. Some rearers took full advan-

tage of the classes and registered a daily attendance during the 3 years 1911 to 1913 in spite of the fact that their homes were 10 miles away. The total number of men entered over the period was 30 of which 12 were awarded the prize. In 1913, owing to an epidemic of flacherie arising from some *eggs* imported from France, the number of worms submitted for examination was vastly increased.

4) *The baking of cocoons.* — Until the Station was established the rearers in the district had no proper baking plant, so that they were obliged to market their cocoons without delay and often lost over their hurried transactions. The baking was immediately undertaken by the Station free of charge and the value of the treatment was so clearly and quickly demonstrated that a cooperative society was soon formed for the erection of ovens on the Murcia plain. In the 3 years 1911 to 1913 the new plant dealt with over 25 tons of cocoons for its members, while the Station treated about 22 tons in 1911 and 8 tons in 1912.

In 1913, no heating was done at the Station as the oven in the new premises was not yet ready.

5) *The free distribution of eggs.* — In Table II are set out details of the distribution of silkworm eggs.

TABLE II. — *Silk-worm eggs distributed by the Silk Experiment Station of Murcia between* 1910-1913.

| Periods | Provinces | Villages | Breeders | Amount of silk-worm eggs |
|---|---|---|---|---|
| December 1910 . . . . . | 14 | 28 | 36 | 49 ounces and 20,30 grms. |
| Year 1911 . . . . . | 20 | 42 | 96 | 75 » » 27.50 » |
| Year 1912 . . . . . | 20 | 58 | 186 | 116 » » 20.78 » |
| Year 1913 . . . . . | 20 | 46 | 240 | 138 » » 22.50 » |

6) *Demonstration farms.* — In cases where the nature and position of a farm and the quality of its farmer make it suitable for demonstration purposes, the Station provides a free equipment. This includes young mulberry trees to supplement or enlarge the plantations, *graine* and all the apparatus required for the rearing of silkworms, including an incubator. When possible, a skilled workman is also sent from the Station for the rearing season, but in any case help and advice are always given and these demonstration farms are looked upon as official sub-stations. During the 3 years 1911 to 1913, 39 such farms were established.

7) *Free distribution of mulberry cuttings and seeds.* — From 1910 to 1913, 69 753 cuttings and 18 lbs. of seed were distributed.

8) *New headquarters of the Station.* — The State has taken over land from the Province in order that the Station should be enlarged and reorganised. The grounds now include 2 ¼ acres of newly planted mulberries, 21 000 1-year old trees, 21 000 2-year old trees, and 9000 3-year

old trees. Irrigation can be practised if necessary as there is a good well with a motor pump. A new oven for cocoons has been built.

9) *Development of the various branches.* — The writer points out that the organisation will need to be extended more particularly as follows:

*a*) The cultivation of the mulberry tree must receive more attention, manurial trials should be made and methods of pruning tested.

*b*) Itinerant inspectors and advisers should be appointed.

*c*) Cold storage should be established for the hibernation of *graine* with store rooms large enough to hold 30 000 oz. of *graine*, so that all the rearers of the Murcia district would be able to use them.

*d*) The Station should undertake the disinfection of rearing houses as enquiries on this subject are constantly being received.

*e*) The foundation of a practical School of Agriculture and of a school for the special training of workmen is also under consideration.

1204 – **Wild Silkworms of Africa** — See this *Bulletin* Nº. 1162.

## FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

1205 – **Manufacture and Co-operative Supply of Agricultural Machinery and Implements in the Russian Empire in 1913** (1). — I. Дешевой М.), (Dechevoj M.), Manufacture of agricultural machinery in Russia, in *Матина въ сельскомъ Хозяйствъ* (Agricultural Machinery), Nos. 10 and 11, pp. 392-394 and 430-434. Kiev, May 31 and June 15 1916. — II. Коваль В. (Koval V. D.), Co-operative supply of agricultural machinery, *Ibid*, No. 1. pp. 11-16. Kiev, January 15, 1916.

I. — The Office for Agricultural Machinery in the Russian Ministry of Agriculture has collected data as to the manufacture of machinery and implements in Russia in 1913 The more important of these are as follows.

The total number of undertakings engaged in the production of agricultural machinery and implements in 1913 was 921 (against 826 in the previous year), of which 770 were in 48 provinces of European Russia, 108 in Poland, 27 in the Caucasus and 16 in Siberia. All these concerns manufactured in 1913 machines and implements of a value of £ 6 437 000 (£ 5 366 000 in 1911 and £ 5 600 000 in 1912), of which £ 5 841 000 came from the provinces of European Russia, £ 491 700 from Poland, £ 45 070 from the Caucasus and £ 59 260 from Siberia. The industry has developed especially in Southern Russia, notably in the province of Kheron, followed in decreasing order by the provinces of Ekaterinoslav, Taurida, Kharkov and the Don Cossacks. Elsewhere the manufacture of farm machinery is highly successful in the provinces of Moscow, Orel, Kiev, Livonia, Warsaw, Perm, Kaluga and Lublin.

(1) On this subject : in 1911, see *R.* 1914, No. 562 ; in 1912, see *R.* 1915, No. 949.

As regards output the factories are divided into the following four groups:

| Value of output of each factory | Number of factories | Total value of output |
|---|---|---|
| 1) less than £ 1 064 | 568 | 149 900 |
| 2) from £ 1 064 to £ 10 640 | 248 | 900 600 |
| 3) from £ 10 640 to £ 106 400 | 96 | 2 895 200 |
| 4) more than £ 106 400 | 9 | 2 492 200 |
| Totals | 921 | 6 437 900 |

*Value and distribution of the output of agricultural machinery and implements in* 1913

| | | £ | £ |
|---|---|---|---|
| Implements for soil cultivation | Ploughs | 1 187 000 | |
| | Harrows and cultivators | 147 000 | 1 347 000 |
| | Rollers | 13 000 | |
| Drills | in rows | 654 000 | |
| | special and combined | 59 000 | 754 000 |
| | broadcast | 41 000 | |
| Machines and implements for hay making | Scythes | 107 000 | |
| | Mowers | 900 | 147 900 |
| | Rakes and tedders | 5 000 | |
| | Baling presses | 35 000 | |
| Machines and implements for corn harvesting | Sickles | 58 000 | |
| | Mowers | 907 000 | 1 158 400 |
| | Reapers | 193 000 | |
| | Binders | 400 | |
| Thrashing machines | horse | 1 471 000 | |
| | steam | 23 000 | 1 521 000 |
| | hand | 18 000 | |
| | special | 9 000 | |
| Apparatus for winnowing and sorting grain | | | 265 000 |
| Machinery for manufacture of feeding stuffs | | | 149 000 |
| Motors | | | 356 000 |
| Other agricultural machines and implements | | | 704 000 |

The third group is thus the most important, while the last, with only 9 works, produced 38.7 per cent of the Empire's total output.

The total number of employees engaged in the industry in 1913 was about 40 000.

The value of the output of agricultural machinery and implements in 1913 is divided as shown in the accompanying table. The production of thrashing machines comes first, followed by cultivating, harvesting and sowing machines; then come motor machinery, cleaning and sorting

machines and finally machines for preparing food stuffs. The largest increase in output in 1913 was in thrashing machines. Before the war the demands of Russian agriculture for this type could be almost completely satisfied, with the exception of steam thrashing machines. The output of very small works is not included in the above data, as exact figures are not available, but this is very considerable throughout the Russian Empire.

II. -- The co-operative supply of farm machinery in Russia is assuming some importance. Actually, of a total value (£ 13 000 000) of machines sold on the Russian market in 1914, 10.8 per cent, or £ 1 502 000 represents purchases made by members of credit associations or by their district societies.

The development of the co-operative supply of agricultural machinery by members of such organisations can be realised from the following figures: in 1912 1 638 co-operators bought goods value £ 677 000; in 1913 their number rose to 2 457 and value of their purchases to £ 1 011 000; in 1914 their number was 3 000, or 20 per cent of the total number (15 000) of co-operators in Russia at that time.

A good proportion of these co-operators are combined in district societies. Eleven of the latter included 723 co-operators, or 24.1 per cent of those dealing in agricultural machinery. The total purchases made by the 11 societies in 1914 reached £ 104 000, or 7 per cent of the total co-operative supply. The majority of the societies belong to Southern Russia and the value of the purchases made by each of them ranges from a minimum of £ 2 120 (Ekaterinslaw society) to a maximum of £ 32 000 (Ektarinbourg society). In spite of the large differences in their purchases, there is a common side to the societies' activities which should not be overlooked. The co-operative supply of machinery is not limited merely to acting as middleman between the manufacturer and the farmer, but is closely related to the improvement of agriculture in the district and consequently is co-ordinated to its needs. For example, almost half the societies have agricultural experts in their service or special adviser who regularly work for them. The greatest activity has been displayed by the Kouban society which has its own staff comprising: 6 agriculturalists, a special expert to the society and advisers in special branches.

The co-operative societies are not satisfied with dealing only, which does not touch the problem of providing the population with agricultural machines, and accordingly they have embarked on co-operative manufacture. An interesting example of this movement is found in the venture of the Melitopol society which has put up a factory for making winnowing machines with an actual output of 1000 per annum. As this venture proved very successful, the directors of the Melitopol society decided last year to start the co-operative manufacture of other agricultural machines. The Ekaterinbourg society has also shown much energy in the construction of its factory: the initiative of this organisation has been favourably received by the Ministry of Agriculture, the Imperial Duma and the Zemstvos. The idea of forming co-opertive factories for agricultural machines is under consideration in other societies, and if the latter succeed in combining

in one organisation, the « Central Society », the problem, according to the writer, should be solved in the near future.

1206 - **Motor Ploughing in France.** — I. De Cabausse P. The present trend of mechanical cultivation, in *La Vie agricole et rurale*, 6th year, No. 41 (entirely devoted to mechanical cultivation) (1), pp. 269-274, 5 figures. Paris, October 7, 1916. — II. Lefort H., New types of ploughs. *Ibidem*, pp. 275-278, 5 figures.

I. — The writer begins by relating the drawbacks of the light petrol tractor which depreciates quickly. He asks if there is not good cause for a return to steam traction. According to Massignon, president of a vineyard syndicate in Anjou, steam could usefully be resumed if the makers would build light machines. It is weight only which puts these motors into dis-

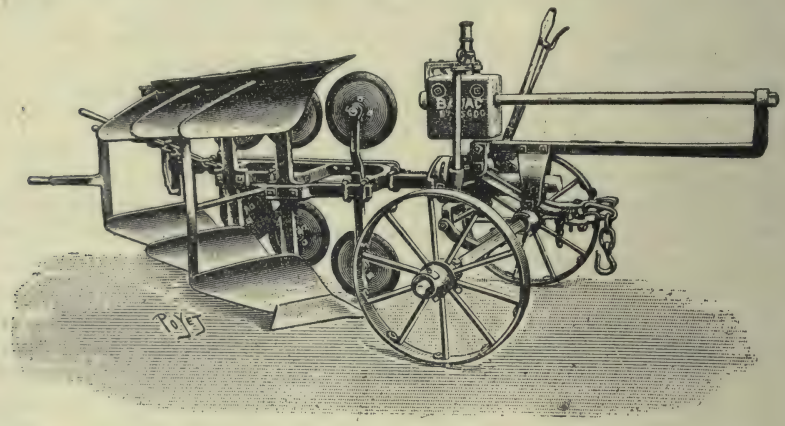



Fig. 1. — Bajac counterbalance plough with moveable balance weight.

favour. The steam engine has an immense advantage over the petrol engine in flexibility: the former can develop, if necessary, three times its nominal power, which the latter cannot do, and it gives a very uniform speed of traction. The return to steam traction will be hastened, according to the writer, by the high prices of paraffin and petrol, which are likely to be permament on account of the increased consumption.

Besides the question of the tractor, the writer discusses the choice of the cultivating implement, and he considers the advisability of replacing the plough with coulter, share and mould board, by a driven implement.

At the Grignon trials, organised by the Minister of Agriculture in 1913, the judges were not favourably impressed by the machines with driven implements. The writer thinks that the latter should not have been rejected

(1) Besides those abstracted, this number contains the following articles: Dr. Chaveau, Mechanical cultivation. — Schribaux Motor cultivation and soil tilth. — P. Buchard. Demonstration of machines for motor cultivation. — P. Buchard, Public trials of cultivating machinery in 1916. (*E. N.*)

without a larger number of trials: their success depends on the proportion of moisture present in the soil at the time of ploughing.

The writer further deals with cable traction, but does not think that there is much scope for this in France.

II. The majority of the ploughs used for motor cultivation are identical with those designed for animal traction. The only difference is in the greater number of furrows which they can make.

It is difficult to improve the working parts of ploughs so the greater number of modifications during the last few years have centred round the ease of handling the implement.

The writer thinks the BAJAC counterbalance plough with moveable balance weight is particularly interesting (fig. 1): the effort to reverse the

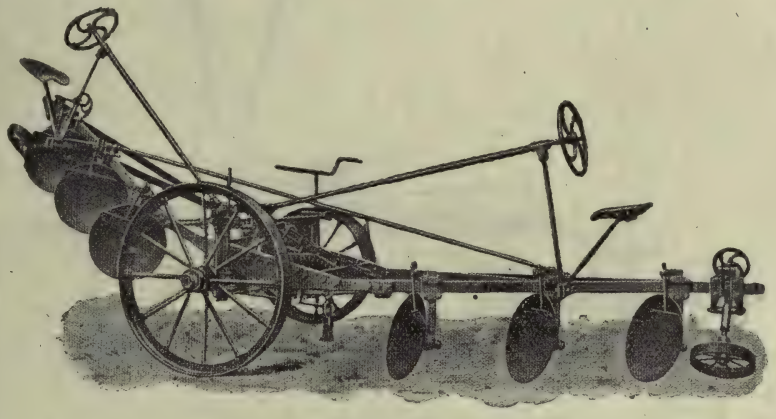


Fig. 2. — BAJAC disc plough.

plough at the headland becomes excessive when the weight of the machine is increased. In order to avoid this, the designer has placed the moveable balance weight on a sliding rod in front of the plough; the length of the rod is calculated so that the weight of the moving mass almost exactly balances that of the body when it is at the extreme end of the rod. The effort required to turn the machine is then very slight; on the other hand, when working, the weight is carried a little behind the place of support, on the body side, which increases the grip.

The writer also mentions the BAJAC disc plough (fig. 2) and the GILTER plough with automatic lift, (fig. 3) specially designed for mechanical cultivation. This machine uses the adhesion of the soil to the supporting wheels of the plough to lift the shares. The shares are raised, not in one block, but one after the other; the same method is used for starting the furrows.

To mitigate the trampling of the animals at the bottom of the furrow, the writer notices the GERTANI plough; he also mentions the MELANI plough with turning fore-carriage — the FLOVER balance-plough which can make

at will either furrows 12 inches broad and 8 inches deep or 16 inches broad and 12 inches deep.

Other recent improvements tend to facilitate the manipulation at the headlands; in the system FALKENBERGER (1) the two bodies turn simultaneously around a horizontal axis, the rotation being caused by the reaction of the ground on the moving body through the agency of a stop. The " Syracuse Reversible " plough has two bodies mounted on separate beams, one turning the furrows to the right, the other to the left; the share is lifted by a pedal or by a spring mounted on a lever which transmits the task of lifting the share to the team, leaving the driver free to steer the team



Fig. 3. — GILTLR plough with automatic lift.

at the turns. The other share turns automatically and the whipple-trees come into place by sliding to the end of a hake, so that the machine follows the line of traction.

In order to lift at the headland in some types of multi-furrow ploughs, the tractor driver has only to clutch a cam-shaft when all the shares are successively lifted. The power required is thus small and the headland is not left in a saw-tooth pattern which reduces the tilth. The writer also describes the « Leviathan » drain-plough (already noticed and illustrated in Bulletin 1915, N.° 1329), exhibited at the Smithfield show (London) December 1915 by Messrs MACLAREN.

1207 - **Simple Method of Calculating the Cost of Mechanical Cultivation.** — DE FONTGALLAND A. (Correspondent) in *Comptes Rendus des séances de l'Académie d'Agriculture de France*, Vol. II, No. 28. Paris, July 10, 1916.

An easy method of finding the cost of work to be paid by each member of the organisations for mechanical cultivation is very desirable. Experience of motor-ploughing shows that the petrol consumption (and hence

(1) See *B.* 1915, No. 420.

the net cost of the work) varies in the proportion of 1 to 3, according to type of soil and the depth of ploughing. On these data M. de PONCINS, agricultural advisor to the « Union du Sud-Est » (France), instead of taking as a basis the area and depth of work or the time taken, has found it much simpler to base his costs on the actual consumption of petrol on the work.

The members thus pay only for petrol used, at net price, plus a surcharge of 1*s* 10*d* per gallon to cover other costs, calculated in the following way:

Assuming that the tractor works on a average 150 days each year, at a rate of 5 acres per day, or 750 acres per annum, and that, on average soils it uses about 4 1/2 gallons of petrol per acre. The surcharge then amounts to 8*s* 1*d* per acre, divided as follows:

| | *s* | *d* |
|---|---|---|
| Depreciation of tractor: £480 in 4 years . . . . | 3 | 1 1/2 |
| Labour: 2 men . . . . . | 1 | 7 |
| Oil, grease, waste. . . . . | | 11 1/2 |
| Insurance: fire and accident: £13 per annum. . | | 4 |
| Repairs: £36 per annum . . . . . | | 11 1/2 |
| Spares, general expenses, sundries . . . . . | | 11 1/2 |
| Total per acre . . . | 8 | 1 |

These annual costs amount to £300 for 750 acres, or 62.5 per cent of the price of the tractor.

For example, if a member's job has consumed 88 gallons of petrol, he pays the society the cost of 88 galls. plus 88 × 1*s* 10*d* = £ 8 1*s* 4*d*.

Taking the net cost of petrol at 2*s* 9*d* per gallon and supposing two ploughing jobs, one in light soil using 2.1 gallons per acre, the other in very heavy soil (5.3 gallons per acre), in each case the cost per acre will work out as follows:

| | Soil | | | |
|---|---|---|---|---|
| | Light | | Very heavy | |
| | *s* | *d* | *s* | *d* |
| Petrol used. . . . . | 7 | 3 1/2 | 14 | 7 |
| Surcharge . . . . . | 4 | 10 | 9 | 8 |
| Total . . . | 12 | 1 1/2 | £1 4 | 3 |

Accounts are thus easy to make out and the management is simpler, since it is only necessary to measure the petrol used.

1208 – **Dust Explosions and Fires in Grain Separators in the Pacific Northwest.** — PRICE J., in *United States Department of Agriculture, Bulletin*, No. 379. Washington, D. C., August 1916.

In a very detailed study, the writer examines in the first place the causes which have produced some 166 explosions from the middle of July to the end of September 1915. He then shows the means used for fighting these as well as the results obtained which were most conclusive.

A whole series of observations have made under the direction of the

Department of Agriculture during the summer of 1914 (1). The hypothesis of spontaneous combustion of smut-dust which was current at this time, lacks confirmation. It was abandoned in favour of the theory of static electricity. As at this date it was already suspected that the dust produced during threshing had been the cause of accidents, the Department of Agriculture towards the end of the 1914 season procured samples of smut-dust from threshing machines. This material proved to be extremely inflammable; it was necessary therefore to direct the investigation in this direction in order to solve the problem.

This important question was examined by a number of experts from the " Bureau of Chemistry ", and from the " Office of Public Roads and Rural Engineering ". In about 150 cases the investigators were on the scene at the time of the explosion or very soon after. In some cases the explosion was so sudden that the workmen could give very little information.

The accidents occurred most frequently from the end of July to the end of August ; from 6 to 10 explosions each day were recorded during this period (2). From observations made in 128 different cases, the most critical time of the day is from 2 to 7 p. m. In 81 per cent of the cases the fires were put down to dust explosions ; in the other cases the flame produced was small. Particular care was directed to the point of origin of the explosion or fire : in 82 out of 108 cases observed (76 per cent), it was behind the cylinder, or very close to it.

Two hypotheses have been put forward to explain the fires : (1) incendiarism ; (2) natural causes.

The first hypothesis has been discarded. There only remains the second explanation and in 75 per cent of the cases the accident was attributed to static electricity and to explosions of dust from smutty wheat.

The threshing machines were of many different kinds : the power used does not seem to have any influence. In fact as many explosions occurred in machines driven by petrol motors as in those driven by steam. Out of 113 machines examined ; 18 had petrol motors, 93 were driven by steam engines, 1 by an electric motor and 1 by horse power. Although the steam-driven machines were in a great majority, they were not subject to more frequent accidents, contrary to general opinion.

The speed of the machine, although sometimes excessive, does not seem to have any connection with the origin of the fire.

Out of 112 explosions, almost all of which occurred during threshing, the wheat contained from 1 to 35 % of smut. 15 % of the explosions occurred with dirty wheat. Only 3 explosions occurred with perfectly clean heads.

The question of hot axle-boxes as a cause of fire was examined with negative results.

(1) See *R.* 1915, No. 536.

(2) It was practically the same as in 1914.

The damage to the machines varied from slight derangement to total destruction. The total damage for all machines was $ 60 000.

In almost all cases the flame from the explosion was blown into the straw pile and sometimes spread to the grain in sacks. Several hundred acres of grain were thus destroyed, the loss amounting to about $ 50 000. Seventy-five per cent of the machines were provided with some form of fire-fighting equipment.

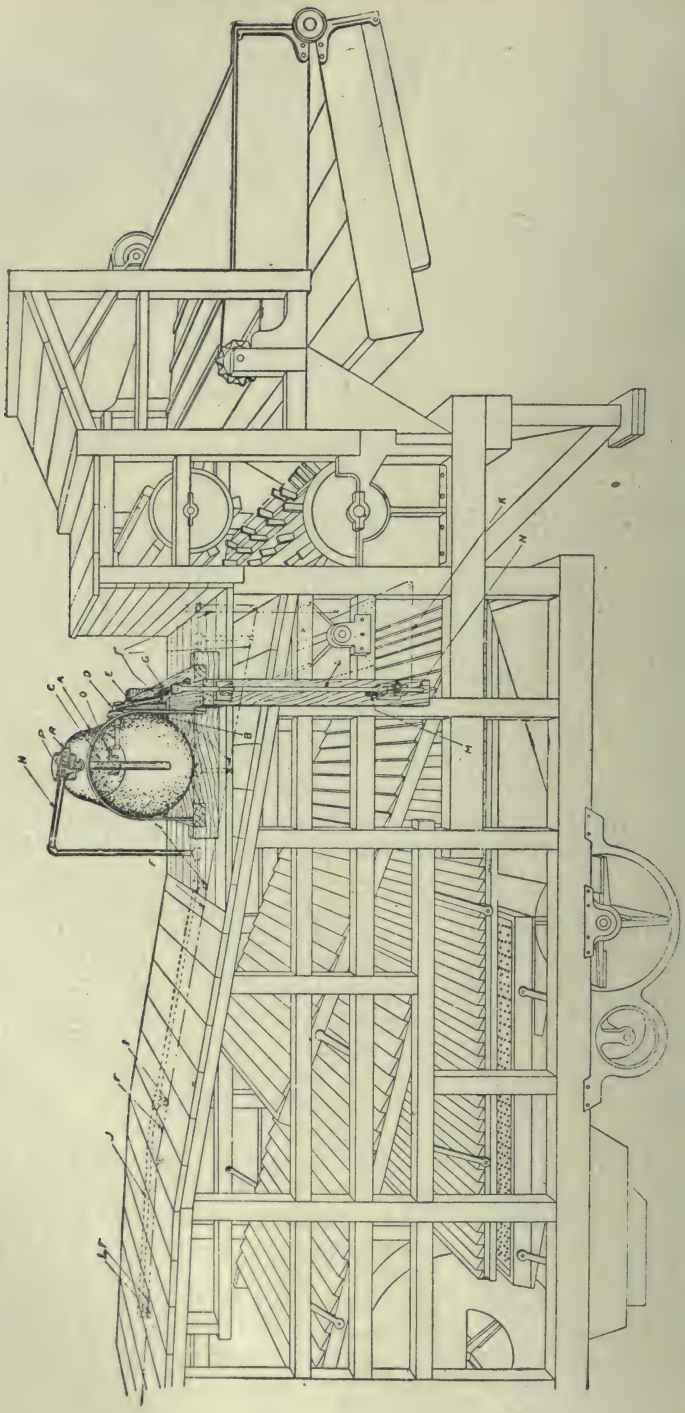
*Static electricity as a cause of explosions.* — It was evident from the beginning of the investigation that a large quantity of static electricity was generated during the operation of the threshing machine. The writer quotes a case in Idaho where a machine was completely destroyed as the result of an explosion. It was situated more than 15 miles from the railway and more than 4 miles from the main road. On the other hand the workmen were neighbours or men known to be reliable. The enquiry made it quite clear that the fire was due to static electricity (the weather was hot and dry). The wheat contained 31 % of smut.

In another case the owner of a threshing machine had his attention turned to the cylinder at the time of the explosion. He observed a long blue spark coincident with the explosion.

In one case the owner stated that his machine was very heavily charged with electricity on the morning of the explosion, to such an extent that that it was not possible to touch any metal part without shock, a condition which had never been noticed on this machine before. The explosion was violent and totally destroyed the machine.

*Mill explosions.* — The theory of dust explosions is not exactly new, and yet it is not generally believed that an explosion can occur in the absence of inflammable gas. But experiment has shown that dust produced by handling wheat can be ignited and cause serious explosions. The extremely fine state of division of the dust, combined with a sufficiently high temperature bring about the phenomenon. It has been shown in the laboratory of the University of Idaho that an electric spark can explode dust. Experiments made in the " Pittsburgh Testing Station of U. S. Bureau of Mines " indicate that to produce complete combustion of 0.12 oz. of coal dust requires all the oxygen in 1 cubic foot of air. Cereal smut dusts are very inflammable, more so than ordinary cereal dust. The explosions observed were of two different kinds : one quick and sharp and the other resembling a loud roar, lasting longer than the first and accompanied by more flame. The concussion produced by the original ignition shook the dust settled in the machine and gave rise to the explosion flame. The mixture of smut-dust and air may have limits of explosibility, and it is quite possible to have too much or too little dust present for an ignition. For this reason explosions may occur at a given time and under certain conditions and not occur at other times or under different conditions. These conclusions are drawn from the Pittsburg experiments mentioned above.

*Methods developed for preventing explosions or extinguishing fires.* — The writer described the investigations made on this point. The first method consisted of an arrangement of conducting wires connected to all the moving



*Extinguisher.*

Automatic fire extinguisher fitted to a threshing machine.

parts to one part and from this part a single conductor is led to earth. This is a repetion of the 1914 experiment but considerably more points were connected to earth.

The second method used a suction fan in order to prevent the formation of an explosive mixture.

These two methods have been used with success on some machines whilst others which were not so fitted were burnt.

*Automatic fire extinguisher.* — As it was not possible to demonstrate that the above methods actually prevent explosions, the investigators decided to rely upon an automatic fire extinguisher which would afford protection irrespective of the cause of the fire. Such a device, illustrated in the figure given here, is composed of the following parts : a tank A mounted on top of the machine, contains a bottle C filled with sulphuric acid : a discharge pipe H ; a tripping mechanism composed of operating levers G and a main tripping lever L ; a trigger N ; discharge nozzles I ; and fuses F mounted in a wire line.

The tank is filled with a solution of carbonate of soda. In the discharge line between the tank and the machine may be mounted a three-way valve from which a hose connection may be made for extinguishing outside fires.

The apparatus works as follows: the presence of sufficient heat will melt one of the fuses F, break the line wire thus releasing the trigger which frees the tripping mechanism. This breaks the bottle containing the sulphuric acid which falls into the soda solution and sets free carbonic acid. This generates sufficient pressure to force the water through the discharge pipe and the nozzles to all the crevices of the separator. The position of the fuses will vary with each machine and must be selected so that they are sure to be reached by the flame or heat, but not so placed that the wire connecting them is likely to be broken by the straw or by the moving parts of the thresher.

A full size working model was constructed and tested in the explosion galleries of the Bureau of Mines at Pittsburgh, and 27 trials were made. In no case did the extinguisher fail to operate successfully. Four different types of threshing machines were tried at the Arlington Experimental Farm and in each case the fire was extinguished before any damage was done.

1209 - **Mechanism for Clutching and Declutching the Feed Device in Straw Balers.** — *Deutsche Landwirtschaftliche Presse*, 43rd year, No. 78 p. 634, 2 figures. Berlin, September 27, 1916.

In automatic straw-balers different mechanisms have to be put in or out of action from time to time, at fixed intervals, through the agency of parts driven with a regular rotary or reciprocating movement. The operations are usually effected by means of a toothed wheel fixed in the compression channel which after a certain number of turns, brings about the necessary clutching. Now, as this toothed wheel moves slowly, it cannot give a sudden movement; besides this requires a certain amount of power which the toothed wheel can only give partly or not at all.

These objections have induced WELGER Bros., of Seehausen (district

of Wanzleben, Germany), to design a motion (German patent No. 29244
which is released by the moving parts of the press, and at the right momen
by the toothed wheel. The latter does not perform the necessary work whic
is now done by the new piece of mechanism.

Figures 1 and 2 show the parts at two phases in the cycle of operations
the toothed wheel *a* turns a cam *b*, controlling a weighted trip *c* which, aft

*Clutching and declutching mechanism.*

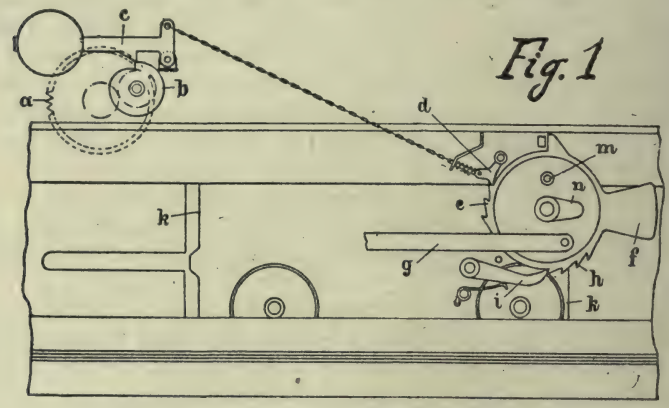



Fig. 1. — Clutching phase.

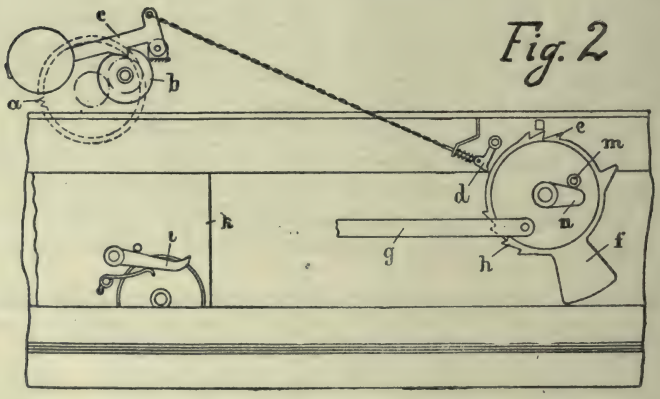



Fig. 2. — Declutching phase.

so many turns of the wheel *a* corresponding to the size of the bale, falls ar
thus releases the pawl *d* at the right moment ; this in turn sets free a balan
weight *f* furnished with ratchet teeth *e*, which passes from the position show
in fig. 1 to that in fig. 2, controlled by any suitable device, *e. g.* the pin
and the stop *n*. This movement is used to clutch and declutch through (sa
the link *g*.

In order that the final position may be maintained for a certain time and, on the other hand, that the original position may easily be regained, the following arrangement is provided: the balance weight *f* is fitted with a second group of ratchet teeth *h* with which a pawl *i* engages; this pawl is linked to a part driven with a regular reciprocating motion, *e. g.* the compressor-ram *k*. At each blow of the ram, this pawl causes the balance weight disc to advance one tooth at a time up to the last of the teeth *h*. Then the movement of the pawl *i* ceases to take effect, and the pawl *d* keeps the balance weight in the raised position, as well as during the intervals in the ratchet action.

The cycle of movements begins again only after the toothed wheel releases the pawl *d* in the way just described. Then the weight *f* falls when the ram retires to the left, and the pawl *i* leaves the teeth *h*.

## 1210 – Review of Patents.

*Tillage machines.*

| | | |
|---|---|---|
| Germany | 290 344 | Plough with harrowing device. |
| | 290 345 | Anchors for motor ploughs. |
| | 290 821 | Device for regulating the height of the chassis in motor ploughs. |
| | 291 093 | Device for fixing the depth of the furrows in double ploughs. |
| Austria | 69 469 | Device for regulating the height of the steering wheel in motor ploughs. |
| | 69 486 | Protective device for motor plough wheels. |
| | 29 490 | Device for repairing the mouldboards of ploughs after fracture. |
| | 69 624-70 454 | Motor ploughs. |
| Canada | 168 447 | Roller. |
| | 168 558 | Plough. |
| | 168 605-168 642 | Cultivators. |
| United States | 1 186 880 | Disc plough and cultivator. |
| | 1 187 310 | Control for cultivator chassis. |
| | 1 187 326 | Coulter and fixing device for disc harrows. |
| | 1 187 488 | Attachment for multi-furrow ploughs. |
| | 1 187 559 | Chassis for multi-furrow ploughs. |
| | 1 187 560-1 189 365 - 1 189 587 | Ploughs. |
| | 1 187 789 - 1 187 790 | Multi-furrow ploughs. |
| | 1 187 870 — 1 191 430 | Cultivators. |
| | 1 187 907 | Attachment for harrow. |
| | 1 188 184 — 1 188 431 | Attachment for ploughs. |
| France | 480 370 | Device suitable for motor ploughs and other multi-furrow machines. |
| United Kingdom | 480 424 | Soil cultivating machine. |
| | 5 328 — 6 305 — 8 564 — 100 612 | Ploughs. |
| | 486 | Harrow. |
| | 8 556 | Motor plough. |
| Holland | 1 480 | Strike plough for sugar cane plantations. |

*Drainage and irrigation.*

| | | |
|---|---|---|
| Germany | 291 153 | Irrigation system. |

*Manufacture and distribution of manures.*

United States 1 187 953 — 1 187 954 — 1 188 725 — 1 189 658 — 1 191 670 Manure spreaders.
France 480 509 Process for increasing the productiveness of the soil.
480 569 New process for manufacture of compound manures.
United Kingdom 5 487 Manure distributors.

*Drilling and planting machines.*

Germany 290 049 Potato planter with cellular disc having edges bent back externally.
290 133 Drill or manure spreader with easily raised distributors.
290 567 Drill with one lever controlling both the covering coulter and the distributors.
290 994 Potato planter.
Austria 70 261 Device for emptying the hoppers of drills.
70 393 Potato planter.
United States 1 186 632 — 1 186 954 Drills.
1 189 019 Corn drill.
1 189 358 Potato planter.
Denmark 21 348 Potato planter.

*Care of growing crops.*

Germany 290 450 Sulphuring process.
290 951 Process for controlling disease in vines.
291 094 Grafting tool for fruit trees.
Austria 70 657 Diaphragm pump for sprayer.
United States 1 189 332 — 1 189 890 Sprayers.
United Kingdom 6 914 Singling hoe for roots.
6 923 Singling hoe for turnips.

*Destruction of vermin.*

Germany 290 610 Process for destroying small rodents with powdered sulphur.
290 611 Process for making insecticide.
Austria 70 513 Trap for musk rats (*Fiber Zibethicus*).

*Harvesting machines.*

Austria 69 982 Guards for hay-tedders.
6 997 — 70 096 Rakes.
Denmark 21 364 Mower.
21 398 Binder.
United States 1 188 190 — 1 188 210 Horse rakes.
United Kingdom 5 894 Hay-lift.
6 768 Hay-tedder.
8 242 Horse rake.

*Machines for harvesting roots.*

United States 1 187 873 Potato digger.
1 189 255 Root puller.
1 191 355 Beet puller and topper.
1 189 853 Beet topper.

| | | |
|---|---|---|
| France | 479 964 | Device for laying beets and other roots in rows after mechanical pulling. |

*Winnowing and threshing machines.*

| | | |
|---|---|---|
| Austria | 70 113 | Threshing machine with chaff extractor. |
| United States | 1 190 137 | Clover-gin. |
| | 1 191 853 | Threshing machine. |
| United Kingdom | 100 850 | Threshing machine. |

*Transport, dressing and storage of crops.*

| | | |
|---|---|---|
| Germany | 290 080 | Mangold and straw cutter. |
| | 290 568 | Device for removing dust from chaff and grain. |
| Austria | 70 380 | Installation for sulphuring hops. |
| | 70 382 | Hop drier with contiguous screens rocked in reverse directions. |
| | 79 813 | Chaff-cutter. |
| | 70 814 | Feed chain for chaff-cutter. |
| | 71 101 | Feed device for chaff-cutter. |
| Canada | 168 072 — 168 152 | Silos. |
| | 168 559 | Feed mechanism for silage cutter. |
| United States | 1 187 739 | Binder. |
| | 1 187 363 — 1 187 742 | Hay stacking machine. |

*Poultry farming.*

| | | |
|---|---|---|
| United Kingdom | 100 662 | Incubator. |

*Manufacture of vegetable products.*

| | | |
|---|---|---|
| Austria | 69 623 | Oven. |
| | 69 627 | Scraping device for kneading machine. |
| | 69 658 | Oven with moveable shelves. |
| Holland | 1 441 | Apparatus for clarifying juice from sugar cane. |
| | 1 458 | Process and apparatus for extracting juice from sugar cane and other sacchariferous plants. |

*Dairy industry.*

| | | |
|---|---|---|
| Germany | 291 284 | Butter making machine. |
| Austria | 69 488 | Control device for milking machine. |
| | 69 628 | Plate centrifuge. |
| | 69 829 | Device for filling and closing milk bottles. |
| Canada | 168 280 | Pulsator for milking machine. |
| | 168 400 | Pasteurising apparatus. |
| | 168 826 | Churn and butter maker. |
| Denmark | 21 315 | Device for milking machine. |
| France | 48 050 | Milking machine. |
| Holland | 1 092 | Improvements in teat-cup diaphragms in milking machines. |
| United Kingdom | 5 582 | Milking machine. |

*Steering and traction of farm machinery.*

| | | |
|---|---|---|
| Germany | 290 239 | Steering gear for drills and similar machines. |
| Austria | 70 807 | Plough tractor with steering wheel in front of driving wheel. |
| Canada | 168 223 — 168 224 — 168 439 | Tractors. |

United States 1 191 267 Steering gear for tractors.
1 191 817 — 1 191 853 — 1 191 423 Tractors.
United Kingdom 100 436 Tractor.

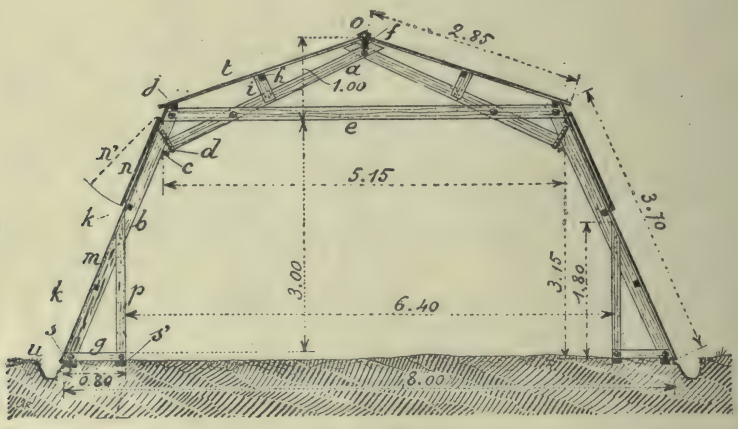
*Miscellaneous.*

Germany 291 095 Tool for making holes for square piles.
291 377 Rubber pad for horse-shoes.

FARM BUILDINGS.

1211 – **Portable Building.** — MAURIN G., in *Journal d'Agriculture pratique*, 80th Year, New Series, Vol. 29, No. 18, pp. 310-312, 2 figs. Paris, September 7, 1916.

The Gonot-Gorgeon portable building can be put to a great number of uses : stables, byres, shops, dwelling houses, etc. The writer describes the simplest type of temporary structure which can be erected in a few days with previously prepared material.




Portable building : Transverse section.

The truss is formed of two stout uprights *b*, each connected with a rafter *a*, by wrought iron straps *d* ; the foot of the rafter buts on a ledge *c* fixed to the upright *b*. Coupling bolts hold the uprights and the rafters *a*. The foot of the upright *b* is triangulated by a strut *p* and tied to the latter by coupling bolts *g* which are seated on the raising-piece *s*.

The structure is closed by wood panels with but-joints and internal cross-bars, those for the roof being 9 ft. × 3 ft. and those for the sides *m* 12 ft. × 3 ft. These panels are covered with tarred felt or similar material. The trusses are spaced 9.8 ft. from centre to centre.

The structure is very rigid and gives little hold to the wind. Rain water is discharged by two lateral drains *w*. The building can be floored and will last for some years, if treated every other year with a coat of tar and sand. A mixture of two parts of tar with one part of resin may also be used hot.

## RURAL ECONOMICS.

1212 - **The Sources of Farm Profits and Their Relative Importance.** — Otis D. H.° and Gunn R. V., (Wisconsin College of Agriculture) in *Hoard's Dairyman*, Vol. LI, No. 23, pp. 900, 905, 918-821. Fort Atkinson, Wisc., June 30, 1916.

Ths report, presented at the third annual meeting of the Wisconsin State Farm Management Demonstration and Farm Contest, sums up the results of the third year's work in which nearly 1 300 farms have participated

As the majority of Wisconsin farmers grow four or five different crops and keep two or three classes of livestock it was necessary to find out how much each crop and each class of livestock contributes to the net results of the farm, in order to make a just award of the prizes given for farm management. The problem could only be solved indirectly, for the farmers had not kept detailed accounts but were only able to give, with any exactitude, the entries in their cash-books, showing the total receipts. No analysed figures were available as to the distribution of the expenses for labour, food, manures etc. The question has therefore been approached in the following indirect way :

Careful cost accounting records keps by different Wisconsin workers under the direction of O. A. Juve of the U. S. Department of Agriculture, the Minnesota bulletin on the cost of producing farm products, the investigations of former Wisconsin Agricultural students, and figures taken from the chief writers on rural economy, have all been consulted in order to arrive at a standard cost per crop per unit area, and per animal unit. This standard cost is the average for several farms for a series of years, so that extremes due to a good or bad year and a good or poor farm are avoided. The standard cost per unit for the various crops and classes of livestock has been worked out by the close and detailed analysis of available figures, and the results are given in Table I.

The profit per unit area for the different crops and the profit per animal unit for the various classes of beasts can be calculated by means of the standard cost per unit, being given the distribution of the crops of a farm and the number of beasts it carries, and also the gross yield for each crop and each class of beast.

This is illustrated in Table II. Column B shows the area devoted to each crop, and the number of beasts kept on the farm ; column C gives the total cost based on the standard cost per unit ; column D shows the percentage obtained by dividing the standard cost of each individual crop or class of live stock by the total standard cost ; column E shows the distribution of cost obtained by applying the percentage in column D to the total expenses ; column F gives the gross returns for each crop and each class of livestock ; column G shows the profit on each crop and class of livestock, obtained by subtracting the actual cost (E) from the gross returns (F) ; column H shows the average profit per acre for each crop and per animal unit for each class of livestock.

TABLE I. — *Standard or average cost of producing crops and keeping live stock.*

| Crops | | Live Stock | |
|---|---|---|---|
| Crop | Cost per acre | Class | Cost per animal unit |
| | $ | | $ |
| Barley | 14 | *Cattle kept by:* | |
| Corn | 18 | General dairyman | 75 |
| Oats | 13 | Pure-bred breeders | 100 |
| Peas | 20 | Market Milk Producers (Special) | 125 |
| Rye | 10 | Sheep (7 sheep or (14 lambs) | 75 |
| Wheat | 13 | Hogs (1 500 lbs) | 75 |
| Potatoes | 30 | Poultry (100 hens) | 75 |
| Alfalfa | 13 | | |
| Clover | 10 | | |
| Clover and Timothy | 9 | | |
| Silage | 25 | | |
| Pasture | 5 | | |

TABLE II. — *Application of method of using standard costs to determine the actual costs on an individual farm.*

| *A* Crop or class of livestock | *B* Acres or Units | *C* Standard Cost | *D* Per cent expense | *E* Actual Cost | *F* Income | *G* Profit | *H* Profit per acre or unit |
|---|---|---|---|---|---|---|---|
| | | $ | | $ | $ | $ | $ |
| Barley | 4 | 56 | 1.3 | 52 | 131 | 79 | 19.70 |
| Oats | 17 | 221 | 5.1 | 204 | 327 | 123 | 7.23 |
| Alfalfa | 17 | 221 | 5.1 | 204 | 525 | 321 | 18.88 |
| Clover | 12 | 120 | 2.7 | 108 | 350 | 242 | 20.10 |
| Clover and Timothy | 20 | 180 | 4.1 | 164 | 420 | 256 | 12.80 |
| Silage | 17 | 425 | 9.7 | 389 | 472 | 83 | 4.55 |
| Pasture | 54 25 | 273 | 6.2 | 248 | 248 | — | — |
| Cattle | 26.75 | 2 675 | 61.2 | 2 452 | 3 658 | 1 206 | 45.00 |
| Hogs | 2.7 | 199 | 4.6 | 184 | 282 | 98 | 36.30 |
| Total | — | 4 370 | 100 | 4 005 | 6 413 | 2 458 | — |

TABLE III. — *Standard and actual costs compared; average of 25 farms in Barron County.*

| | No. farms averaged | Standard cost per farm | Actual cost per farm |
|---|---|---|---|
| *Crops.* | | $ | $ |
| Barley | 16 | 109 | 110 |
| Oats | 25 | 204 | 211 |
| Peas | 2 | 360 | 419 |
| Rye | 6 | 44 | 46 |
| Wheat | 6 | 39 | 50 |
| Potatoes | 9 | 246 | 243 |
| Alfalfa | 8 | 23 | 21 |
| Clover | 15 | 110 | 129 |
| Clover and Timothy | 17 | 169 | 170 |
| Silage | 20 | 385 | 391 |
| Pasture | 25 | 236 | 249 |
| *Livestock.* | | | |
| Cattle | 25 | 1 552 | 1 627 |
| Sheep | 2 | 457 | 427 |
| Hogs | 22 | 228 | 217 |
| Total expense per farm | | 2 976 | 3 095 |

TABLE IV. — *Relative profitableness of different farm crops.*

| *A* Crop | *B* No. of farms averaged | *C* Acres per farm | *D* Profit per farm | *E* Profits per farm |
|---|---|---|---|---|
| | | | $ | $ |
| Barley | 41 | 8.7 | 67.58 | 7.74 |
| Corn | 34 | 12.3 | 28.18 | 2.28 |
| Oats | 72 | 18.4 | 114.45 | 6.21 |
| Peas | 2 | 18 | 370.00 | 20.55 |
| Rye | 13 | 7.7 | 43.54 | 5.64 |
| Wheat | 16 | .62 | 13.44 | 3.70 |
| Potatoes | 10 | 8.5 | 186.86 | 21.88 |
| Alfalfa | 46 | 9.76 | 224.15 | 22.95 |
| Clover | 46 | 11.74 | 194.45 | 16.55 |
| Mixed hay | 58 | 17.14 | 152.53 | 9.37 |
| Silage | 65 | 19.43 | — 58.64 | — 3.92 |
| Pasture | 75 | 43.4 | — | — |

In order to obtain a standard, this method was applied to a group of 25 farms, the resulting figures being given in Table III ; it is obvious that in the average figures for the 25 farms there is a remarkable agreement between the standard expense calculated according to Table I and the actual expense obtained by applying the percentage figures to the total cost credited to each farm.

The average results on 78 farms divided into four different groups according to their size, show the same general tendencies and the same relative profitableness of each crop that was indicated in Table III. The averages for the four groups are given in Table IV.

The same method was applied to the study of the livestock situation, 58 farms being considered, divided into three groups according to the cattle units they possessed. The results are indicated in Table V.

TABLE V. — *Relative profitableness of livestock on 58 farms.*

| | | Number of farms | Units of livestock per farm | Profit or Loss per farm | Profit or loss per unit of livestock |
|---|---|---|---|---|---|
| | | | | $ | $ |
| Group I 25 farms | Cattle | 25 | 19.6 | — 410 | — 20.95 |
| | Sheep | 3 | 6.1 | — 68 | — 11.04 |
| | Hogs | 22 | 2.8 | 48 | 16.52 |
| Group II 18 farms | Cattle | 18 | 26.6 | — 417 | — 15.63 |
| | Sheep | 3 | 3.2 | — 101 | — 31.56 |
| | Hogs | 15 | 4.4 | — 49 | — 11.11 |
| Group III 15 farms | Cattle | 15 | 38.6 | 1 146 | 29.64 |
| | Sheep | — | — | — | — |
| | Hogs | 6 | 2.25 | 44 | 19.55 |

On the 25 farms of group I only 3 are making a profit, while on 22 the livestock is kept at a loss in spite of the profit on the hogs. This is explained by the low production of the milking cows, which is only valued at 58 per cow. If the method of analysis is correct the profit of this group of farms is made on the crops and not on the livestock with the exception of hogs.

On the farms of group II the hogs were raised at a loss relative to the value of food consumed, while in group III a profit was realised both on milking cows and hogs.

For the purpose of comparison, calculations have been made of the returns for the food consumed in the 3 groups, the average of individual production for each milking cow and the receipts per animal unit. The

figures in Table VI explain the causes which influenced the results set forth in Table V.

TABLE VI. — *Returns for feed consumed.*

| | Group I | Group II | Group III |
|---|---|---|---|
| | $ | $ | $ |
| Value of feed fed | 1 280 | 1 424 | 3 311 |
| Returns per $ 1 of feed fed | 1.17 | .87 | 2.04 |
| Receipts per cowdairy products | 58 | 62 | 114 |
| Receipts per animal unit | 65 | 45 | 173 |
| Profits per animal unit | — 16 | — 18 | 30 |

The receipts from crops, livestock and from miscellaneous sources, with the corresponding profits are shown in Table VII.

TABLE VII. — *Total receipts and net profits per farm.*

| Receipts and profits per farm | Group I | Group II | Group III |
|---|---|---|---|
| | $ | $ | $ |
| Total receipts | 3 265 | 2 867 | 9 741 |
| Crops | 1 619 | 1 359 | 2 685 |
| Livestock | 1 493 | 1 380 | 6 773 |
| Miscellaneous | 153 | 128 | 308 |
| Net profits | 174 | 405 | 2 086 |
| Crops | 399 | 42 | 617 |
| Livestock | — 378 | — 575 | 1 161 |
| Miscellaneous | 158 | 128 | 1 308 |

The third year's work concluded with the announcement of these results, visits to the farms and the award of the prizes gained. In the future much more exact information will be available. Prior to 1915 the records were obtained by the survey method by which the farmer is asked a series of questions, many of the answers to which must be estimates. In 1916, out of the 600 farmers interested in the work 365 kept their books in a satisfactory manner. For the coming year 1917 over 800 farmers have promised to keep their records.

Also, in 6 counties executive committees have been formed to organise the work of farm management work in their respective counties. The farmers themselves are so interested in the movement that the best results may be expected, and it is possible that in the near future they will contribute financially to defray expenses and to aid in the extension of this demonstration work.

1213 – **Statistical Researches on the Chief Factors Which Influence Farm Profit in Denmark.** — NANNESON I., in *Dansk Land*, Year IV, pp. 35-53. Copenhagen, February 1916.

These statistical researches are based on data collected by the Office for Agricultural Accounts at Malmøhus (Malmøhus Lens Bogføringsforening).

The economic result of agricultural enterprise may be considered in various ways, depending upon whether the type of enterprise be of a capitalist nature or merely seeks to find a useful outlet for labour, as on the farms of the peasant proprietors. The wage value for the work done gives an index of the profit-making capacity of farms under peasant proprietors, and a comparison is made with the interest on capital on other types of farms. The statistical method is used for making this comparison in order to bring out clearly the factors by which farm profits are influenced.

*Farms under peasant proprietors.* — Data were obtained from 14 farms and a calculation has been made of the value of the labour of the owner's family after deducting a fair interest on the capital laid out (at 4 ½ per cent for capital invested in land and 6 per cent for working capital) from the returns for the work done. Value for work done is compared with the normal wage value, calculated on the scale of the wage of the local labourers. This is set out in Table I, which also gives the net profit per acre and the rate of interest on capital obtained on each farm.

The large differences in the net profit per acre are accentuated in the rate of interest because of the different amounts of capital invested per acre. The rate of interest fluctuates from a minimum of 0.2 per cent to a maximum of 9.4 per cent, averaging 4.9 per cent for the 14 farms. Consequently there are equally big differences in the wages earned by the owner's family, which vary from 47.5 per cent to 144.2 per cent of the normal wages, averaging 99.7 per cent. On account of these large variations, the farms have been divided into two groups according to the interest yielded in order to find out by what factors the profit-making capacity is determined. The factors for the two groups of farms are compared in Table II. In the first group the gross return from livestock is much greater than in the second, the return from cows and pigs being double, and that from other stock being more than double. In spite of their less favourable economic emplacement the farms of group I have given an increased net return of 44*s* per acre, so that the interest in group I is 7.2 per cent and in group II is only 2.2 per cent. The value of the work done on the farms of group I is double that in group II, although the working expenses are almost the same in both groups. It appears, therefore, that intensive cattle rearing is the most profitable way of employing labour on the

TABLE I. — *Value of work done on the farms of the peasant proprietors.*

| Farm | Net profit per acre | | | Rate of interest on capital invested | Return for work done by the owner's family | | | | Actually obtained in percentage of local wages |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Calculated according to local wages | | Actually obtained after deducting interest on capital | | |
| | £ | *s* | *d* | per cent | £ | *s* | £ | *s* | |
| 42 | | 6 | 6 | 0,9 | 55 | 18 | 34 | 16 | 62,2 |
| 43 | 4 | 8 | 0 | 5,7 | 33 | 11 | 37 | 7 | 113,3 |
| 44 | | 15 | 5 | 1,2 | 55 | 18 | 32 | 4 | 57,6 |
| 45 | 2 | 15 | 0 | 8,6 | 67 | 2 | 94 | 8 | 140,7 |
| 46 | 2 | 15 | 6 | 5,0 | 55 | 18 | 56 | 12 | 101,2 |
| 47 | 3 | 6 | 6 | 7,9 | 55 | 18 | 66 | 16 | 119,5 |
| 48 | 3 | 6 | 6 | 6,0 | 67 | 2 | 76 | 6 | 113,8 |
| 49 | — | 1 | 6 | — 0,2 | 44 | 14 | 21 | 5 | 47,5 |
| 50 | 2 | 13 | 6 | 4,2 | 55 | 18 | 46 | 15 | 83,6 |
| 51 | | 6 | 6 | 0,5 | 33 | 11 | 6 | 11 | 19,5 |
| 52 | 1 | 10 | 6 | 4,2 | 55 | 18 | 51 | 19 | 92,9 |
| 53 | 2 | 18 | 6 | 6,4 | 67 | 2 | 80 | 12 | 120,2 |
| 54 | 3 | 9 | 9 | 6,6 | 61 | 10 | 106 | 12 | 117,8 |
| 55 | 3 | 7 | 6 | 9,4 | 67 | 2 | 96 | 16 | 144,2 |

farms of the peasant proprietors, and that if this method be not practised it is impossible to realise the normal returns on work and capital.

The lower profit-making capacity of the second group is partly due to the smaller area of the farms which average 2.75 acres less; if the farms are grouped according to area, the difference is less marked.

| Area of farms | Net profit per acre | | Rate of interest |
|---|---|---|---|
| | *s* | *d* | per cent |
| Up to 10 acres . . . . . | 42 | 6 | 3.8 |
| From 12.5 to 25 acres . . . . . | 48 | 6 | 5.7 |

In relation to the area, the value of the buildings was much greater in the first group than in the second but the number of farms studied is not great enough to allow of any general conclusion being drawn.

*Other farms.* — The diagram on page 1672 relates to capitalist farms and illustrates the statistics from 72 farms, which are arranged from left to right in dimi-nishing order of the rate of interest they yield.

It appears from this diagram that there are great differences in organisation and intensity of working even on farms which give the same net re-

TABLE II. — *Figures relating to the farms of the peasant-proprietors, Farms arranged in two groups according to the rate of interest yielded.*

| | More profitable group | Less profitable group | Difference |
|---|---|---|---|
| Average area | 15.75 ac. | 13 ac. | + 2.75 ac. |
| Economic emplacement | 3.0 | 3.4 | — 0.4 |
| Class of productivity | 3.1 | 2.6 | + 0.5 |
| Capital invested per acre | £ 35 8*s* | £ 40 7*s* | — £ 4 19*s* |
| Working capital » » | £ 14 | £ 8 12*s* | + £ 5 8*s* |
| Gross return from milking stock | £ 5 13*s* | £ 2 17*s* | + £ 2 14*s* |
| Gross return from pigs | £ 3 17*s* | £ 2 4*s* | + £ 1 13*s* |
| Gross return from other livestock | £ 1 18*s* | £ 0 16*s* | + £ 1 2*s* |
| Total gross return per acre | £ 13 16*s* | £ 11 7*s* | + £ 2 10*s* |
| Cost of labour per acre | £ 5 0*s* | £ 5 1*s* | — £ 0 1*s* |
| Cost of concentrated foods per acre | £ 2 17*s* | £ 1 18*s* | + £ 0 19*s* |
| Total working expenses per acre | £ 10 9*s* | £ 10 3*s* | + £ 0 6*s* |
| Net profit per acre | £ 3 8*s* | £ 1 4*s* | + £ 2 4*s* |
| Rate of interest on capital invested | 7.2 per cent | 2.2 per cent | + 5.0 per cent |
| Return for work done | £ 30 | £ 14 6*s* | + £ 15 14*s* |
| Return for work done in percentage of normal wages | 125.3 per cent | 69,0 per cent | + 56.3 p. cent |

TABLE III — *Farms grouped according to the date of interest yielded*

| Group | Rate of interest | Capital invested per acre | Gross return per acre | Cost of labour | | Working expenses less interest per acre | Net return per acre | Per cent of total yield | | Economic emplacement |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | per acre | per cent of gross return | | | from crops | from stock | |
| | per cent | £ *s* | £ *s* | £ *s* | | £ *s* | £ *s* | | | |
| I | 8.9 | 51 19 | 13 6 | 3 7 | 25.4 | 8 14 | 4 12 | 55 % | 31 % | 4,30 |
| II | 7.0 | 54 9 | 12 11 | 3 8 | 27.1 | 8 15 | 3 16 | 52 | 30 | 4,15 |
| III | 6.1 | 53 6 | 11 8 | 3 3 | 27.6 | 8 3 | 3 6 | 47 | 32 | 3,85 |
| IV | 5.4 | 57 6 | 11 6 | 3 3 | 28.1 | 8 6 | 3 1 | 46 | 30 | 4,00 |
| V | 4.2 | 53 4 | 10 8 | 3 6 | 32.0 | 8 4 | 2 5 | 51 | 29 | 4,00 |
| VI | 3.1 | 53 19 | 9 13 | 3 1 | 31.8 | 8 1 | 1 13 | 47 | 34 | 4,00 |
| VII | 0.8 | 49 14 | 8 12 | 3 6 | 38.3 | 7 19 | 13 | 42 | 36 | 3,70 |

TABLE IV — *Returns from the different groups of farms, arranged according to the intensity of cultivation.*

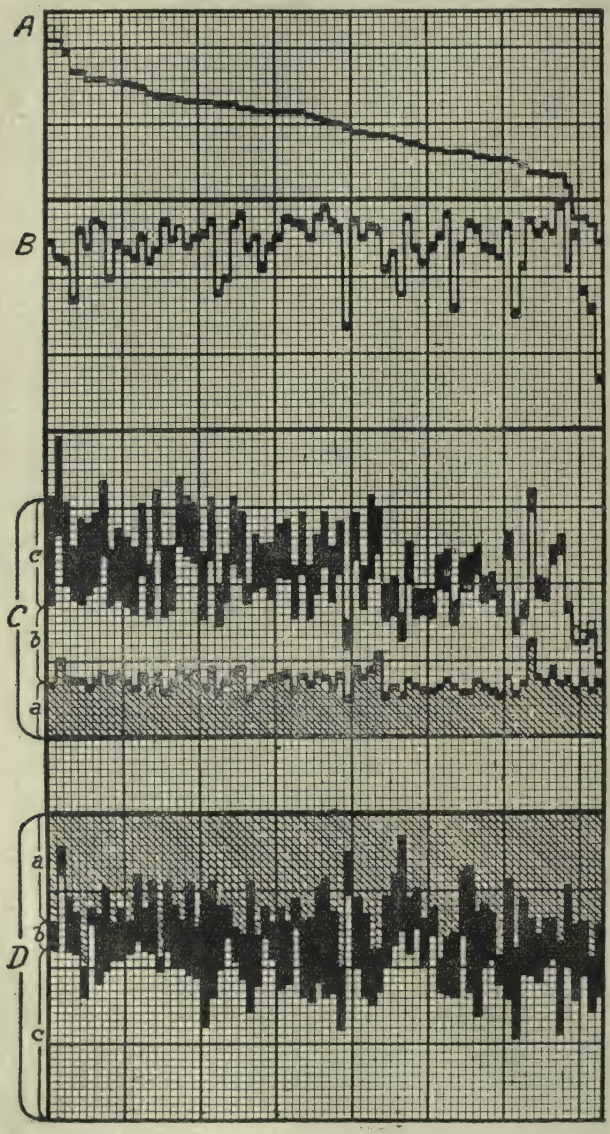
| Group | Working expenses + interest per acre | Net profit per acre | Rate of interest | Economic Emplacement | Percentage of farms yielding an interest of more than 4 per cent |
|---|---|---|---|---|---|
| | *s d* | *s d* | per cent | | per cent |
| I | 264 0 | 56 0 | 5.26 | 4.15 | 80 |
| II | 242 6 | 60 0 | 5.60 | 4.08 | 75 |
| III | 223 0 | 60 6 | 5.50 | 4.05 | 65 |
| IV | 206 4 | 59 6 | 5.77 | 4.05 | 70 |
| V | 193 6 | 55 5 | 4.56 | 4.05 | 65 |
| VI | 147 1 | 26 0 | 3.15 | 3.61 | 45 |

TABLE V. — *Returns from the different groups of farms, arranged according to the percentage of total returns that is derived from crops.*

| Group | Percentage of total returns yielded by crops | Net profit per acre | Rate of profit | Economic emplacement | Productivity of cereal crops | Percentage of farms yielding a profit of more than 4 per cent |
|---|---|---|---|---|---|---|
| | | *s d* | per cent | | point | |
| I | 60.2 | 66 0 | 6.51 | 3.95 | 3.82 | 80 |
| II | 53.5 | 65 | 6.17 | 4.05 | 3.91 | 80 |
| III | 50.5 | 48 | 4.62 | 4.10 | 3.83 | 60 |
| IV | 46.8 | 49 0 | 4.93 | 4.02 | 3.80 | 55 |
| V | 42.9 | 51 | 4.35 | 3.90 | 3.58 | 60 |
| IV | 37.9 | 45 0 | 3.82 | 3.97 | 3.41 | 50 |

turn. This is particularly noticeable on the two farms which yield the largest profit On farm No. 2, the gross return per acre was 75*s* higher than that on farm No. 1, while the cost of labour was 31*s* per acre more. On farm No. 2 the crops provided 80 per cent of the total yield, whereas in No. 1 they only made up 55 per cent. As such different methods of organisation give similar economic results it is very difficult to specify the best types of farm for a given district, and any classification that is attempted is open to criticism. Nevertheless it is clearly evident from the diagram that the gross return per acre decreases with the profit-making capacity. This is shown still more clearly by the average figures for groups of 10 farms, given in Table III, where the gross return per acre falls from £ 13 6*s* in group I to £ 8 12 *s* in group VII. This proves that the lower profit-making capacity is directly connected with the lower production per unit area. Comparing the best group with the worst the net return per acre fell from £ 4 12*s* to

DIAGRAM. — *Economic results from 72 farms.*




*A*. Rate of interest, per cent.
*B*. Capital invested per acre.
*C*. Gross returns : *a*) cost of labour
*b*) other working expenses
*c*) net profit per acre.
*D*. Percentage of gross returns derived from : *a*) cattle
*b*) various products
*c*) crops.

(1) 1 krone (Danish) = 1s. 2*d*.

TABLE VI. — *Returns from the different groups of farms, arranged according to the percentage of total returns that is derived from livestock.*

| Group | Percentage of total return yielded by livestock | Net profit per acre | Rate of interest | Economic emplacement | Productivity: quantity of milk per cow (1 point = 264 galls) | Percentage of farms yielding a profit of more than 4 per cent |
|---|---|---|---|---|---|---|
| | | *s d* | per cent | | points | |
| I | 42.8 | 44 6 | 3.81 | 3.95 | 4.25 | 50 |
| II | 36.9 | 48 0 | 4.06 | 3.97 | 4.15 | 50 |
| III | 33.8 | 54 0 | 4.95 | 4.20 | 4.15 | 60 |
| IV | 31.2 | 55 6 | 5.37 | 3.97 | 4.00 | 70 |
| V | 27.6 | 58 6 | 5.56 | 3.88 | 3.95 | 75 |
| VI | 22.0 | 59 6 | 5.54 | 3.97 | 3.75 | 75 |

13*s*, but the corresponding reduction in working expenses was only 15*s*. This explains why the rate of interest was only 0.8 per cent in the worst group, while it was 8.9 per cent in the best. The crops provide 55 per cent of the total yield in the best group of farms, and only 42 per cent in the worst, while the livestock represent 31 per cent and 36 per cent respectively.

*Cost of labour.* — The cost of labour per acre does not vary much in the groups of farms, the greatest difference being only about 1*s* per acre. On the other hand, when compared with the gross return the labour expenses rise from 25 per cent in the group giving the greatest yield to 38.3 per cent in the group giving the lowest yield. It is therefore clear that the great *relative* increase in the cost of labour is one of the chief causes of the poor economic results of the worst group of farms. This point has not been sufficiently considered in studying the economy of farming, and it deserves special attention, particularly when the cost of labour is high. Low economic results depend chiefly on excessive labour expenses in comparison with the return per unit area. The profits, both for crops and livestock, are much too low, and the reason can only be that the work is not properly looked after, so that the labourers become slack.

*Relation between profit and intensity of cultivation.* — The intensity of cultivation of a farm is indicated by the cost of labour and working expenses together with the interest on the land, *i. e.* by the total cost of production. The farms have been arranged in order on this basis, and have then been grouped in such a way that extra-ordinary factors have been eliminated as far as possible. In Table IV group I comprises the first 20 farms, group II contains No. 11 to No. 30, group III No. 21 to No 40 and so on. The two groups with the lowest intensity of cultivation give the poorest results, but the rate of interest reaches its maximum when the cost of production is about £ 10 6*s* per acre, and decreases when this limit is passed, showing that the increase of intensity of cultivation beyond a certain point is not advisable.

*Relation between profit and the relative proportion of crops and livestock.* — In Table V the farms are grouped in descending order according to the percentage of the total yields given by the crops, and in Table VI according to the percentage of the total yields given by the livestock.

Increase in the percentage of crops sold is nearly always followed by increased profit, and there is no indication that a limit has been reached beyond which it would be disadvantageous to pass, but this is not the case with animal products. Two groups have been formed in order to study the second factor which affects the profits ; in group I the profit exceeds 5 per cent., in group II it is less than 5 per cent. Only those farms have been considered in which the return from livestock exceeds 35 per cent of the total return and the chief factors bearing upon milk production have been isolated as follows :

| | Group A | Group B |
|---|---|---|
| Number of farms | 10 | 12 |
| Rate of interest | 6.4 per cent | 6.4 per cent |
| Economic emplacement | 4.2 points | 3.8 points |
| Value of milk per gallon | $5\frac{3}{4}$ *d* | $5\frac{1}{2}$ *d* |
| Degree of productivity *i.e.* quantity of milk per cow, in points (1 point = 264 galls) | 4.3 points | 3.8 points |
| Gross return per £100 invested in livestock | £125 18*s* | £93 2*s* |

While the farms in group A yield a profit of 6.4 per cent, those in group B yield only 1.4 per cent. This is due to various causes : in group A the milk is worth $\frac{1}{4}$ *d* per gallon more than it is in group B, while the production of milk per cow is 132 gallons higher ; also the gross return from the livestock is 125.9 per cent in group A, but only 93.1 per cent in group B, the working oxen being about the same in both groups.

*Relation between profits and the relative area under the various crops.* — The percentage of the total area occupied by cereals, forage crops (greeu forage, roots etc.) and industrial crops (sugar beet, potatoes for distilling etc.) has been calculated for most of the farms studied. In Table VII the farm are grouped in descending order according to the percentage of the total area occupied by each of the three classes of crops.

The greatest profits are made by the groups of farms having 53 per cent of their area under cereals or 27.2 per cent under forage crops. If this optimum is exceeded or not reached the rate of interest decreases until a minimum is reached on those farms growing the largest proportion of forage crops and the smallest proportion of cereals. Increase in the area devoted to industrial crops causes the rate of interest to increase steadily, and the maximum profit does not seem to have been reached even in the first group of 10 farms which have 20.2 per cent of their area under these crops. The extension of industrial crops seems to have a direct bearing upon the economic value of the " emplacement " which is a very im portant factor that must not be lost sight of in considering each group.

TABLE VII. — *Returns from the different groups of farms, arranged according to the percentage of the total area devoted to cereals, forage plants and industrial crops respectively.*

| Group | Percentage of total area | Net profit per acre | Rate of interest | Economic emplacement | Productivity | Percentage of farms yielding an interest of more than 4 per cent | Percentage of total area devoted to industrial crops |
|---|---|---|---|---|---|---|---|
| | | *s d* | per cent | | points | | |
| A. *Cereals.* | | | | | | | |
| I | 59,0 | 52,6 | 4,68 | 4,0 | 3,6 | 65 | 12,5 |
| II | 55,9 | 51,0 | 4,61 | 3,9 | 3,5 | 65 | 12,7 |
| III | 53,4 | 54,6 | 5,25 | 4,0 | 3,6 | 65 | 13,4 |
| IV | 50,8 | 55,0 | 5,12 | 4,2 | 3,8 | 60 | 14,0 |
| V | 45,7 | 49,0 | 4,48 | 3,9 | 3,8 | 55 | 15,1 |
| VI | 42,1 | 43,6 | 4,00 | 3,7 | 3,7 | 50 | 14,5 |
| B. *Forage plants.* | | | | | | | |
| I | 41,6 | 43,0 | 4,15 | 3,9 | 3,8 | 50 | 11,6 |
| II | 35,9 | 53,6 | 5,00 | 3,9 | 3,9 | 65 | 14,1 |
| III | 32,8 | 51,0 | 4,50 | 4,0 | 3,7 | 65 | 13,7 |
| IV | 30,6 | 52,6 | 4,50 | 3,9 | 3,5 | 60 | 13,2 |
| V | 27,2 | 58,6 | 5,55 | 4,1 | 3,7 | 70 | 14,8 |
| VI | 23,5 | 56,0 | 5,30 | 3,9 | 3,8 | 65 | 15,8 |
| C. *Industrial Crops.* | | | | | | | |
| I | 20,2 | 67,0 | 6,53 | 4,2 | 4,1 | 80 | — |
| II | 19,8 | 63,6 | 6,27 | 4,1 | 3,9 | 75 | — |
| III | 16,7 | 64,0 | 5,95 | 4,0 | 3,9 | 80 | — |
| VI | 14,0 | 54,5 | 4,76 | 4,0 | 3,8 | 65 | — |
| V | 12,1 | 42,0 | 3,71 | 4,1 | 3,6 | 50 | — |
| VI | 9,8 | 40,5 | 3,69 | 3,7 | 3,4 | 50 | — |

Generally speaking, the lower profit obtained when smaller areas are devoted to industrial crops must be attributed to the lower economic value of the emplacement and to the low productivity of the soil. High profits are also obtained in some of the groups in which the areas devoted to the definite crops are far below the maximum limits. This emphasises the necessity of studying the economics of various combinations of crops on more abundant statistical data than the author has used in these researches, because when the number of farms in each group is relatively small the influence of extraordinary factors does not permit of general conclusions being drawn.

TABLE VIII. — *Returns from the different groups of farms, arranged according to the percentage of the total area devoted to cereal crops.*

| Group | Percentage of the total area devoted to cereals | Net profit per acre | Rate of profit | Economic emplacement | Productivity | Percentage of farms yielding a profit of more than 4 per cent | Percentage of total area devoted to industrial crops |
|---|---|---|---|---|---|---|---|
| | | *s* | | | Points | | |
| I | 30.4 | 54 | 5.40 | 4.1 | 3.5 | 70 | 13.8 |
| II | 27.9 | 64 | 5.70 | 0.1 | 4.2 | 80 | 13.9 |
| III | 24.0 | 63 | 5.70 | 4.1 | 4.1 | 75 | 14.2 |
| IV | 21.7 | 60 | 5.35 | 4.1 | 3.9 | 65 | 14.8 |
| V | 19.7 | 45 | 5.25 | 4.1 | 3.6 | 55 | 13.6 |
| VI | 15.9 | 39 | 3.88 | 3.7 | 3.3 | 50 | 13.3 |

In Table VIII the farms are grouped according to the areas devoted to bread-making cereals (chiefly wheat). The rate of interest increases through the different groups to a maximum in group II (where cereals occupy 27.9 per cent of the total area), and diminishes again in group I, probably because the productivity points are low, owing to three farms which have an excessively low output apart from the cereals they produce. If these three farms are eliminated, group I with the largest area under wheat (31 per cent) gives the greatest rate of interest (6.8 per cent.) This shows that farms which arrange their land properly find the extension of wheat growing an excellent means of increasing their profit, particularly as in 1913, the year which provided the data on which there researches are based, the profit from wheat was somewhat decreased by the specially low selling price.

1214 – **The "Mougharsa" Form of Contract in Northern Africa.** — See this *Bulletin* No. 1161.

## AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

1215. – **Sulphurous Acid in Chemical Combination in Musts and Wines.** — LABORDE, in *Revue de Viticulture*, Vol. XLIV, Nos. 1139, 1143, 1146, 1147, 1148; pp. 309-314, 373-376, 421-423, 437-440, 453-459; Vol. XLV, No. 1152, pp. 53-57. Paris, April 27, May 25, June 15, 22 and 29, and July 27, 1916.

Analysis proves that sulphurous acid which has been added to musts and wines exists both in the free state, that is merely dissolved, and also in chemical combination with the various constituents of these liquids. The difference between these two states is shewn very clearly by the iodine test, and it is very important from a physiological point of view.

Sulphurous acid has when free a very strong antiseptic action on wine yeast, which it loses almost entirely when chemically combined. There is

the same difference between the two states as regards harmful properties when imbibed, and the regulations concerning the addition of sulphurous acid to fermented drinks have been made with this in mind.

All compounds formed by sulphurous acid in grape must or wine are unstable. They can be destroyed, and the sulphur dioxide completely expelled by heating the liquids to boiling.

The following points have been examined:

I. — THE CHEMICAL COMBINATION OF SULPHUROUS ACID WHEN ADDED TO GRAPE MUST. — The most important ingredient of musts which combines with sulphurous acid is the sugar, a mixture of glucose and fructose.

X. ROCQUES shewed some time ago that though saccharose does not combine with sulphurous acid, yet invert sugar combines very easily with it in aqueous solution, 1 gm. of sugar absorbing about 1 mgm. of it. This proportion is low, but can vary considerably.

Glucose and fructose were compared as regards their power of combining with sulphurous acid. Two solutions of 100 and 200 gms. per litre of invert sugar and a 10 per cent solution of glucose were prepared by allowing invertase from yeast juice to act at a temperature of 40° C. on solutions of saccharose. Other 10 per cent and 20 per cent solutions of invert sugar and 10 per cent solution of glucose were also made by dissolving saccharose in a 0.3 per cent solution of hydrochloric acid at a temperature of 80° C. On all these solutions, obtained by two methods, the effect was tried of adding 1 mgm. and 2 mgms of sulphur dioxide.

The results obtained after letting the solutions stand for 48 hours, all air being excluded, are given in Table I.

TABLE I. — *Combination of sulphur dioxide with glucose and invert sugar.*

| Sulphur dioxide | | 10 per cent glucose solution | | | | 10 per cent invert sugar solulion | | | | 20 per cent invert sugar solution | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | From yeast juice | | From acid | | From yeast juice | | From acid | | From yeast juice | | From acid | |
| | | | % | | % | | % | | % | | % | | % |
| 1) 100 mgms. | total . . | 96 | — | 100 | — | 100 | — | 100 | — | 102 | — | 100 | — |
| | free . . . | 54 | (56.2) | 65 | (65) | 76 | (76) | 54 | (54) | 59 | (57.8) | 22 | (22) |
| | combined | 42 | (43.7) | 35 | (35) | 24 | (24) | 46 | (46) | 43 | (42.1) | 78 | (78) |
| 2) 200 mgms. | total . . | 216 | — | 205 | — | 200 | — | 210 | — | 216 | — | 202 | — |
| | free . . . | 104 | (48.2) | 140 | (68) | 149 | (75) | 144 | (68.6) | 126 | (58) | 65 | (32) |
| | combined | 112 | (51.8) | 65 | (31) | 51 | (25) | 66 | (31.4) | 90 | (42) | 137 | (68 |

From this experiment the following conclusions may be deduced:

Solutions of invert sugar and solutions of glucose prepared by yeast juice combine with much the same amount of sulphurous acid when they each contain the same amount of glucose. But invert sugar obtained by the action of hydrochloric acid and heat has a power of absorption double that of glucose, for in this case the fructose acts too.

The absorbing power of the sugar increases with the temperature and strength of the acid, especially when brought near to the point of caramelling, and when this takes place it is the fructose which first decomposes.

As the proportion of sulphur dioxide which combines with invert sugar varies very much, the amounts of sulphur dioxide were compared which are absorbed by a natural must and by an artificial must obtained by the action of yeast on saccharose. Both musts contained 175 gms. per litre of sugar. The results are given in Table II.

TABLE II. — *Combination of sulphurous acid with grape must and with sugar solution.*

| Amount of sulphur dioxide added per litre | Grape must | | | | Sugar solution | | | |
|---|---|---|---|---|---|---|---|---|
| | Amount of sulphur dioxide combined | | | Ratio of combined to total sulphur dioxide | Amount of sulphur dioxide combined | | | Ratio of combined to total sulphur dioxide |
| | After 1 hours | After 24 hours | After 48 hours | | After 1 hours | After 24 hours | After 48 hours | |
| mgms. | mgms. | mgms. | mgms. | per cent | mgms. | mgms. | mgms. | per cent |
| 100 | 80 | 90 | 95 | 95 | 38 | 45 | 50 | 50 |
| 200 | 150 | 165 | 170 | 85 | 75 | 93 | 95 | 47.5 |
| 300 | 195 | 235 | 242 | 80 | 90 | 140 | 140 | 46.6 |
| 400 | 212 | 285 | 295 | 73.7 | 108 | 175 | 178 | 44.5 |
| 500 | 230 | 335 | 350 | 70 | 48 | 205 | 205 | 40.1 |
| 750 | 270 | 340 | 450 | 60 | 40 | 250 | 285 | 38 |
| 1 000 | 320 | 560 | 570 | 57 | 80 | 270 | 340 | 34 |
| 2 000 | 350 | 840 | 940 | 47 | 60 | 360 | 550 | 27.5 |

It has also been demonstrated that the organic substances which are with the sugar in the cell juices can combine with the sulphur dioxide. To prove this, there was added to one part of a solution of sugar inverted by invertase from yeast, the residue obtained by evaporating nearly to dryness an infusion of yeast corresponding in volume to about four times the sugar solution. In this way the non-sugary elements were considerably increased. To both these solutions, one with and one without the non-sugary yeast residue, and both containing 200 gms. of invert sugar per litre, were added 400 mgms. of sulphur dioxide The same quantity of sulphur dioxide was added to some yeast juice made in the warmth and to some made in the cold. After 48 hours the sulphur dioxide had combined in the following proportions.

| | Sulphur dioxide combined per litre | Residue per litre after evaporation to dryness |
|---|---|---|
| | — | — |
| | mgms. | mgms. |
| Solution enriched with non-sugary substances . | 280 | 223 |
| Solution of invert sugar . . . . . | 202 | — |
| Yeast juice made in the warmth . . . . . | 23 | 156 |
| Yeast juice made in the cold . . . . . | 90 | 540 |

Among other points that have been examined are the influence exerted on the combination of sulphurous acid by 1) the nature of the must; 2) the acidity, which at the strength generally used has no effect; 3) the temperature which, while hastening the action, has within the usual limits, *i. e.* from 15° to 25° C., but little effect on the amount combined; 4) the pressure of the atmosphere which has no influence either. A very low pressure can remove all the free sulphur dioxide, but only acts on combined sulphur dioxide if the temperature is considerably raised. A study has also been made of the disappearance in musts of sulphur dioxide due to evaporation and to oxidation into sulphuric acid by exposure to air.

The action of sulphur dioxide on special musts has been examined. According to experiments carried out by MULLER THURGAN and OSTERWALDER (1), must of healthy grape and of grape infected by *Botrytis cinerea*, to which 0.225 gm. and 0.450 gm. per litre of sulphur dioxide had been added, gave the following results.

| History of must | Amount of sulphur dioxide combined | | | |
|---|---|---|---|---|
| | After 1 hour | | After 3 days without fermentation | |
| | Healthy grapes | Infected grapes | Healthy grapes | Infected grapes |
| | mgms. | mgms. | mgms. | mgms. |
| Must to which 0.225 gm. sulphur dioxide per litre was added . . . . . | 28 | 58 | 52 | 80 |
| Must to which 0.450 gm. sulphur dioxide per litre was added . . . . . | 36 | 78 | 98 | 75 |

These experiments were repeated with *Botrytis cinerea* grown on grape must and on grapes. Some of the results are shewn in Table III.

TABLE III. — *The chemical combination of sulphur dioxide with must of healthy grapes and of grapes infected by Botrytis cinerea.*

| History of must | Amount of acid per litre | Amount of sugar per litre | Amount of combined sulphur dioxide | |
|---|---|---|---|---|
| | | | Per litre of must | Per litre of sugar |
| | gms. | gms. | mgms. | mgms. |
| Natural must from various white grapes, . | 7.1 | 158.6 | 264 | 160 |
| Same must infected by *Botrytis* . . . . . | 0.54 | 147.1 | 260 | 177 |
| Must of Chasselas . . . . . | 2.50 | 161.2 | 270 | 167 |
| Same must infected by *Botrytis* . . . . . | 0.49 | 188.7 | 230 | 149 |

(1) See *R.* 1915. No. 738. (*Ed.*)

It thus appears that, contrary to the conclusions come to by MULLER THURGAN and OSTERWALDER, the increase in the quantity of combined sulphurous acid in the must of infected grapes depends on the concentration of all the ingredients of the must.

The following conclusions may be drawn from the experiments described above;

The combination of sulphur dioxide with grape must depends on the following factors:

1) The proportion of sugar, which can vary largely from that of healthy grape to that infected by *Botrytis cinerea*, called « pourriture noble » because of its enriching effect in certain wines.

2) The proportion of glucose to fructose which is generally equal to 1 in healthy grapes, but which sometimes is less, especially in the must of infected grapes; in this case the amount of combined sulphur dioxide tends to diminish as the fructose is inactive.

3) The existence of other substances than sugar in the must, and the acidity.

4) The physical conditions to which the must has been subjected.

5) A rise of temperature of the must, which, if it does not exceed 25°, hastens combination.

II. — THE INFLUENCE OF SULPHUROUS ACID ON THE FERMENTATION OF GRAPE MUST. — Previous experiments had shewn that if a moderate amount of sulphur dioxide is added to a must rapidly fermenting, it combines very quickly and without interrupting the fermentation. By repeated additions the relatively high proportion of 1 gm. per litre is reached for the combined sulphur dioxide.

A compound of aldehyde and sulphurous acid is produced, as PASSERINI shewed in 1909, and the writer has studied it under the following conditions;

To begin with, he added to two portions of must about 200 and 400 gms. of sulphur dioxide per litre respectively, and this combined entirely with the sugar, and other ingredients of the must. The must was then mixed with pure yeast and allowed to ferment, care being taken to exclude contact with the air as much as possible, and the following changes in the quantity of aldehyde present were noted as the amount of sugar decreased:

| Specimen to which no sulphur dioxide was added | | Specimen to which 200 gms. per litre sulphur dioxide were added | | Specimen to which 405 gms. per litre sulphur dioxide were added | |
|---|---|---|---|---|---|
| Amount of sugar destroyed per litre — gms. | Amount of aldehyde formed per litre — mgms. | Amount of sugar destroyed per litre — gms. | Amount of aldehyde formed per litre — mgms. | Amount of sugar destroyed per litre — gms. | Amount of aldehyde formed per litre — mgms. |
| 20 | 60 | 8 | 105 | 12 | 230 |
| 59 | 125 | 106 | 224 | 59 | 740 |
| 127 | 145 | 162 | 224 | 85 | 370 |
| 162 | 135 | 194 | 210 | 140 | 370 |
| 200 | 95 | 215 | 200 | 166 | 360 |

Aldehyde is formed in the control specimens as in those containing sulphur dioxide, but in much smaller quantities.

The sulphur dioxide is recovered at the end of the experiment with but slight loss, 10 mgms. out of 200, and 15 out of 405. This proves that as fast as the sulphur dioxide is set free from the sugar by the latter's breaking up, it enters into combination with the aldehyde and is thus retained; whereas, if any considerable proportion remained free it would be carried off by the carbon dioxide and much would be lost.

The fermentation of the must is sometimes seen to take place in the presence of free sulphur dioxide, even when a test portion taken from the top of the cask contains a fairly high percentage of sulphurous acid. To explain this, it is suggested that in the lees at the bottom of the cask there is a layer where the free sulphur dioxide combines with the aldehyde produced by the incompletely sterilised yeast. Here fermentation begins, at first but slight, and then with greater and greater evolution of carbonic acid gas according as the layer in which the sulphur dioxide enters into combination, grows in extent. It has been possible to prove this by experiment.

III. — THE INFLUENCE ON FERMENTATION OF SULPHUROUS ACID WHEN CHEMICALLY COMBINED. — *Changes in the rate of fermentation.* — The results of experiments undertaken to elucidate this question are shewn in Table IV.

TABLE IV. — *The influence on fermentation of sulphurous acid when chemically combined.*

| Time elapsed | Fermentation at 15°C. | | | | | Fermentation at 25°C. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No sulphur dioxide $a$ | 200 mgms. sulphur dioxide per litre $b$ | 400 mgms. sulphur dioxide per litre $c$ | Ratio $\frac{b}{a}$ | Ratio $\frac{c}{a}$ | No sulphur dioxide $a$ | 200 mgms. sulphur dioxide per litre $b$ | 400 mgms. sulphur dioxide per litre $c$ | Ratio $\frac{b}{a}$ | Ratio $\frac{c}{a}$ |
| | gms. | gms. | gms. | per cent | per cent | gms. | gms. | gms. | per cent | per cent |
| 1 day . . | 0.8 | 0.15 | 0.15 | 19.0 | 19.0 | 2.2 | 1.05 | 0.65 | 47.5 | 30.0 |
| 2 days . . | 1.2 | 0.35 | 0.35 | 28.5 | 28.5 | 3.6 | 2.2 | 2.15 | 61.1 | 60.0 |
| 3 » . . | 1.65 | 0.65 | 0.65 | 39.4 | 39.4 | 4.65 | 3.25 | 3.05 | 70.0 | 65.6 |
| 4 » . . | 2.4 | 1.55 | 1.35 | 64.5 | 56.2 | 6.4 | 4.65 | 4.25 | 70.0 | 66.4 |
| 5 » . . | 3.2 | 2.95 | 2.00 | 91.5 | 62.5 | 7.45 | 5.8 | 5.35 | 77.8 | 71.8 |

The antiseptic influence of combined sulphurous acid on wine yeast is thus shewn to be perceptible in certain conditions; nevertheless, when the proportion does not exceed 200 mgms. per litre, which is the maximum for musts purified in the ordinary way, the rate of fermentation is but slightly decreased, unless the temperature sinks to below the normal.

*Changes in the selective affinity of yeast.* — Normally, yeasts which cause grape sugar to ferment shew a marked preference for glucose. But

under certain conditions the contrary is the case, especially when fermenting must or re-fermenting sweet wine contains a high proportion of combined sulphurous acid.

One experiment shews clearly the influence of the sulphurous acid on the selective affinity of the yeast. But it is impossible to say whether this is due to a temporary modification of the protoplasm or to a survival of the fittest among the yeasts.

IV. — The chemical combination of sulphurous acid in wines. Wine and must made from healthy grape and from grape infected by *Botrytis cinerea* were compared, and the results shewn in Table V. were obtained.

Table V. — *A comparison of must with wine.*

| | Must from healthy grape | Wine from healthy grape | Must from botrytised grape | Wine from botrytised grape |
|---|---|---|---|---|
| | mgms | mgms. | mgms. | mgms. |
| Free sulphur dioxide . . . . . | 40 | 20 | 40 | 16 |
| Combined . . . . . | 160 | 168 | 160 | 168 |
| Total . . . | 200 | 188 | 200 | 184 |

In both cases the power of wine for combining with sulphurous acid was very little different from that of the must; it was slightly higher because of the existence of traces of aldehyde in the former.

Experiments were also made on the capacity for combining with sulphur dioxide of wines which have fermented in the presence of sulphur dioxide. From the same must two specimens of wine were prepared, N° 1, a control specimen, and N° 2, which had been allowed to ferment in the presence of sulphur dioxide and which contained 296 mgms. sulphur dioxide and 220 mgms. aldehyde per litre. To both wines about 2 mgms. sulphur dioxide was added, and after 48 hours they proved to have the following amounts of sulphur dioxide.

| | Wine N° 1 | Wine N° 2 |
|---|---|---|
| | mgms. | mgms. |
| Free sulphur dioxide . . . . | 20 | 16 |
| Combined sulphur dioxide . . | 168 | 480 (296 + 184) |
| Total sulphur dioxide . . . | 188 | 496 |

This shews that N° 2 has in a combined state only a little more of the sulphur dioxide subsequently added than has N° 1.

*The checking of fermentation.* — A litre of fermenting wine containing still 80 gms. of sugar per litre was divided into three parts, and to each part was added 66 mgms. of sulphur dioxide. To the first portion this

was added directly, to the second after heating to 80° C. to kill the yeast and then cooling, and to the third after filtering to remove completely the yeast. After standing for 48 hours, analysis shewed no difference between the three portions for all contained 20 mgms. of free sulphur dioxide and 176 mgms. of it combined. So the presence of yeast has no influence on the amount of sulphur dioxide that enters into combination when the fermentation is stopped, if the quantity added has been sufficient to stop fermentation at once. Nevertheless, with a view to the later preservation of the wine, it is better to eliminate by a preliminary racking the thick lees at the bottom of the cask, for this might give rise to a slow fermentation which would carry off the free sulphur dioxide.

The different factors which cause variation in the amount of combined sulphur dioxide have been examined, and the results are drawn up in Table VI.

TABLE VI. — *Different factors that regulate the amount of sulphur dioxide that enters into chemical combination.*

| | History of wine | Total sulphur dioxide per litre | Combined sulphur dioxide per litre | Aldehyde per litre | Alcohol per cent | Sugar per litre |
|---|---|---|---|---|---|---|
| | | mgms. | mgms, | mgms. | | mgms. |
| Sauternes | Fermented | 200 | 96 | 0.0 | 16.0 | 5.0 |
| | Fermented | 196 | 146 | 50.0 | 14.0 | 55.0 |
| | Without precipitation | 182 | 126 | 80.0 | 14.0 | 4.5 |
| | After precipitation | 324 | 252 | 135.0 | 11.9 | 45.6 |
| | Preserved normally | 296 | 192 | 87.5 | 14.5 | 55.6 |
| | Refermented | 424 | 352 | 155.0 | 15.0 | 45.6 |
| Monbazillac Wine | After several precipitations | 392 | 392 | 200.0 | 11.0 | 127.0 |
| | Without precipitation | 220 | 140 | 100.0 | 13.5 | 80.0 |

The preservation of some wines of Gironde for about a year were studied, the amount of sulphur dioxide being kept constant by successive additions. It appears that its preservation during two years can be secured by a small total amount of sulphur dioxide if it is added at intervals.

CONCLUSIONS. — The following conclusions may be drawn from these experiments:

1) Sulphurous acid added to grape must soon enters into chemical combination, partly or wholely. The sugar absorbs most of it, but only the glucose, for the fructose is inactive. Other ingredients of the must can also combine with it in measurable quantities which depend on the nature of the must. In an ordinary must when the quantity of sulphur dioxide added reaches 100 mgms. per litre, complete combination no longer takes place, and the proportion of combined sulphur dioxide to total sulphur dioxide decreases as more is added. A state of equilibrium between the free

and combined sulphur dioxide is reached which varies with the nature of the must and the total amount of dioxide. Certain changes, however, in the nature of the must appear to have no appreciable influence on the proportion of combined dioxide; such are changes of acidity within ordinary limits and the the direct action of *Botrytis cinerea.*

2) Sulphur dioxide forms a chemical combination with the aldehyde in the must and is thus completely retained in the wine. The aldehyde is produced by the action of yeast on sugar in the absence of air and when combined with sulphurous acid it escapes much more easily from all hydrogenising and hydrolising actions, which are at their strongest when the yeast has reached its maximum growth and the sugar has grown less.

3) In spite of the greatly reduced antiseptic properties of sulphur dioxide when combined, its presence in a fermenting must can modify the physiological action of the yeast. The increase in production of aldehyde is a proof and further experiments would produce others; an analysis of the products of fermentation would show this.

The rate of fermentation is lightly lessened even by a small amount of combined sulphurous acid not exceeding 200 mgms. per litre, especially at first, and if the temperature is somewhat low; at 25° C. the retarding effect is much less than at 15°.

Finally, the selective affinity of the yeasts seems to be so much influenced by it that the proportion of glucose to fructose becomes higher than 1 during fermentation, and this influence should be studied further because of its effect on the constitution of sweet wines.

4) The proportion of combined sulphur dioxide in cheap table wines, (" vin ordinaire ") does not differ very much from that in the must which produces it. But in the case of a grape must infected by *Botrytis cinerea* and very rich in sugar, the sweet wine it gives rise to has generally a much smaller combining power, very much the same as that of a " vin ordinaire ".

The addition of sulphur dioxide to a must changes but little the combining power of the wine obtained from it, for the initial dioxide is taken up by the aldehyde and the product formed is more or less independent of the other ingredients of the wine. But of course this initial combined sulphur dioxide is extra to the amount of combined dioxide formed by a later addition.

The checking of fermentation can be done in contact with living yeast without using excess of sulphurous acid, so long as enough acid is added to stop the fermentation completely, and that the lees are withdrawn as speedily and completely as possible.

Several factors may necessitate an increase in the total amount of dioxide needed to preserve sweet wines; they concern the method of wine-making, and the later treatment given to these wines. Thus, excessive aeration and a too prolonged fermentation favours the formation of aldehyde, and consequently the combination of sulphurous acid; but precipitation in presence of sulphurous acid and secondary fermentation after sulphiting have a greater effect in increasing the amount of sulphur dioxide which

enters into combination and, consequently, of the amount which must be used.

Therefore precipitation in presence of sulphurous acid, a method seldom now used for musts concentrated by *Botrytis cinerea*, must be avoided as much as possible.

Finally, during three or four years, the normal period of preservation of wines, a certain increase in the amount of combined sulphur dioxide must be expected. This is due to the formation of aldehyde, and to the concentration of the liquid by spontaneous evaporation.

These researches shew that sulphur dioxide in a state of combination plays a very complex part in wine-making, nearly as important as that of the free dioxide. The latter alone can ensure the preservation of sweet wines, and, consequently, care must always be taken that its proportion never becomes less than 25 to 30 mgms. per litre; but since the amount of total sulphur dioxide must never exceed a certain limit, the amount of combined dioxide must be watched also with much care.

Besides, it is always important to preserve heavy wines with as little total sulphur dioxide as possible, and hence it follows that the utmost care must be taken to diminish the amount that enters into combination.

1216 – **The Dessication of Potatoes in Germany.** — PAROW, in *Georgine*, No. 73-74, p. 572 Koenigsberg, Pr., Sept. 9, 1916.

The dessication of potatoes has made rapid strides in Germany. The number of factories grew from 3 in the first year, 1903, to 39 in 1196, 199 in 1909, 403 in 1912, and 488 in 1914.

The need for these factories has become more apparent than ever since the outbreak of the war, and the Government helps to start them by granting subsidies. The " Trocken-Zentrale, " at Berlin was directed to do all that was possible to hasten the construction of dessicators. The " Trocken-Kartoffel-Verwertungs-Gesellschaft " (Society for utilising dessicated potatoes) has been founded in order to collect and distribute the output, and this has helped to increase the number of factories to 721 in 1915. On July, 1916, there were in all in the German Empire 841 factories, which were distributed as follows among the different provinces :

| | | | |
|---|---|---|---|
| Anhalt | 40 | Hanover | 22 |
| Bavaria | 10 | Hesse-Nassau | 1 |
| Brunswick | 8 | Pomerania | 151 |
| Free Towns | 1 | Posen | 152 |
| Hesse, Grand Duchy | 2 | Rhenish Provinces | 3 |
| Saxony, Kingdom | 9 | Saxony, Province | 44 |
| Mecklenbourg | 27 | Silesia | 118 |
| Saxe-Weimar | 3 | Schleswig-Holstein | 2 |
| Schwarzbourg-Rudolstadt | 2 | Westphalia | 2 |
| East Prussia | 43 | West Prussia | 71 |
| Brandenbourg | 130 | | |

The productive power of these works, although considerable, is not sufficient for the present need. The output is large, but is limited by insufficiency of material and workmen, etc. Whilst in 1915 it was not possible to get enough raw material, in 1916, thanks to a better harvest, there will be a bigger supply. But lack of workmen prevent the factories from being used to their full extent.

With the works going continuously day and night for 200 days all the factories of the empire are able to produce 12 million tons of dried potatoes from 30 million tons of raw material.

That the quantity produced by the whole empire does not meet the needs of the population is due to the fact that dried potatoes are wanted for horses too. For if each horse received daily only 4 $^1/_2$ lbs, 2.6 millions tons would be consumed by them in a year. Further, if cattle, pigs, sheep, goats and horses, a total of 60 million head of stock, received 2.2 lbs. of dried potatoes each daily, they would consume 21.9 tons of dried potatoes yearly, and this corresponds to 87.6 tons of fresh potatoes.

The technique of dessication has made surprisingly rapid strides in the few years since it was first started. Cylinders, " Walzenapparate ", and drums " Trommelapparate ", are now generally used. The former can deal with 1.2 or 1.5 tons of potatoes per hour, and the latter up to 5 tons. The fresh potatoes are transformed into a dry substance which is easy to transport and which can be preserved almost indefinitely. They are generally made into flakes and cubes for cattle and into various potato flours for human consumption. The machines are easy to run ; 8 to 10 HP is enough for those of medium size and 15 to 25 for the larger ones. On an average 12 to 14 tons of coal are used for 100 tons of potatoes for the making of flakes, and 8 to 10 tons of coke for the making of cubes.

The total cost of drying 1 cwt. of potatoes is 0.30 to 0.40 mark and from 0.40 to 0.50 mark in the smaller ones (a mark before the war equalled 11 $^1/_2$ *d* and has by now fallen in value to about 8*d*). The cost has gone up slightly since the war. Because of the increased cost of desiccating and the high price of raw potatoes, a maximum price has been fixed for dried potatoes, 22.0 marks per cwt. of flakes and 21.42 marks per cwt. of cubes at the factory.

Reckoning that 4 cwt. of raw material make 1 cwt. of dried product and that 1 cwt. of fresh potatoes costs 4 or 4.5 marks, it will be seen that the desiccation of potatoes pays, even in war time, if the machinery is put to its full use. Higher profits are made if other vegetable products besides potatoes are used, and the greater their variety, the better. The machines for making cubes are the best for this purpose, for they can also desiccate beet root, leaves, cereals, grass, vegetables, and have earned the name of " Allestrockner " (universal desiccators).

Besides preparing stock foods, the machines for making flakes will also in the future be more largely used for preparing food for human consumption.

1217 – **On the Action of Alkalies and Acids on Rubber.** — EATON, B. J., in *The Agricultural Bulletin of the Federated Malay States*, Vol. IV, No. 6, pp. 162-167. Singapore, March 1916.

In a previous number of *The Agricultural Bulletin* (Vol. IV, N°. 2, Nov. 1915), it was shown that solutions of caustic soda and of carbonate of soda perceptibly hastened the vulcanisation of rubber obtained from plantation Para rubber, *Hevea brasiliensis*. Since it had also been demonstrated that vulcanisation is retarded by coagulation with excess of acetic acid, the hypothesis was put forward that the acceleration produced by soda was due to the neutralisation of the residual acid, and the production of a more favourable medium for the organisms which are believed to cause the more rapid vulcanisation.

In order to see whether it was by direct chemical action on the rubber that the alkalies hasten vulcanisation, further experiments were carried out on finished rubbers, that is rubbers in a crepe form. In this way the possibility of biological action was precluded by the dryness of the samples. Two types of rubbers were chosen, a fast and a slow curing rubber. The first had been prepared in the usual way by crepeing slab rubber which had been left standing at least six days, and the second by crepeing fresh coagulum on the day of coagulation. Solutions of caustic soda and caustic potash were used. From the results of these esperiments the following conclusions may be drawn.

1) The effect of soda and potash on rubber is to increase markedly the rate of vulcanisation.

2) This effect is similar on slow and fast curing rubbers.

3) The effect of alkalies appears, at present, to be due to chemical action on some constituent of the rubber, but the evidence on this point is still incomplete, and further researches are being carried out.

4) Sulphuric and other mineral acids, potash alum and probably other mineral salts retard vulcanisation. Their effect is greater with quantities beyond the minimum necessary for coagulation.

5) The results obtained with mineral acids are important in connection with estate practice in view of the probable substitution of sulphuric acid for acetic acid, and show that great care will have to be taken in maintaining standard conditions, more so than in the case of acetic acid, in which a moderate excess over the minimum necessary for coagulation has little effect.

The use of alkalies in the preparation of raw rubber has a deteriorating effect on manufactured rubber goods. This entirely confirms the deteriorating effect found to occur even on the raw rubber after keeping.

1218 – **New Dairy Industry Legislation in New South Wales, Australia.** — O' CALLAGHAN, M. A., in *The Agricultural Gazette of New South Wales*, Vol. XXVII, No. 6, pp. 409-414. Sydney, June 2, 1916.



The " Dairy Industry Act " which was passed December 21, 1915 and came into force June 21, 1916, amends the " Dairy Supervision Act " of 1901 and other acts dealing with the same matter.

The new law regulates the manufacture, sale, storage, transit and export of dairy produce, including margarine, the testing, mixing and

grading of creams, the basis of payment for cream, and for the grading and branding of butters. The Government has given wide powers to the Board of Agriculture, which now controls the work of butter factories throughout, and to a certain extent the work of cheese factories, condensed milk factories and margarine factories. New South Wales is a great butter producing country; hence the particular interest of this question, for it is only butter superior to that hitherto made that can hold its own against margarine in the English market.

When the Dairy Industry Act was passed by the Government, and creams were henceforward classified, the producers of highclass butters and creams benefited as a distinction is now drawn between their goods and those of inferior quality.

The law states that cream must be paid for either on the basis of the butter fat results, as shewn in the O' Callaghan Chart, or on the amount of butter obtainable from such cream.

According to Clause 12, the manager of every dairy produce factory shall grade or cause to be graded all cream supplied to him. He may not mix the various grades of cream or butter. Butter from graded cream shall be put up in packages bearing a hrand registered under the Act representing the grade or quality and the factory if desired.

As hitherto creams of various qualities have been produced it was not easy to provide classification which would bring about the desired result, and at the same time not be too severe on factory managers till they had got accustomed to the workings of the Act. The suggested classification avoids the necessity of grading into more than two qualities for the present. It is clear and simple, and does tardy justice to the producers of untainted cream.

Creams supplied to dairy produce factories must be classified as follows:

N.º 1. — Untainted or choicest.

N.º 2. — Tainted.

Untainted creams must be free from all taints, whether caused by the foods the cows have consumed or by bacterial or any other agency. Such cream should also have a smooth and even texture and should not contain more than 0,4 per cent of lactic acid.

Such creams when made into butter will reach the standard-minimum, 95 points, prescribed in the Commerce Act for superfine butter. No penalty is inflicted if such butter during the 12 months subsequent to the gazettal of these regulations, grades a minimum of 43 points for flavour.

Tainted cream (N.º 2) is subdivided into.

N.º 2 *a* — Lightly tainted.

N.º 2 *b* — Badly tainted.

N.º 2 *a* is cream affected by food taints, slight biological taints, or by a combination of both.

N.º 2 *b* is a cream affected by advanced biological taints, but which has not reached the putrescent stage.

Clause 13 forbids the use of putrescent cream for making butter, and

prescribes that it shall be treated with such substances as shall not destroy their value as animal food. It may be returned to the supplier.

A clause which protects the cream supplies obliges the managers of factories to send every month to the Under Secretary of the Department of Agriculture a statement of the quantity of each grade of butter made in his factory, and the quantity of butter which the suppliers of cream have been paid for.

Butter may not be exported without being graded. If its grade is found to be different from that indicated by the registered brand on the package, it may not be exported under that brand. A certificate of grading shall be supplied to the manufacturer and the exporter.

All butter, cheese and margarine factories must register under the Act and all stores.

A store is defined as a place where condensed milk, butter, cheese or margarine is stored whether in a cold chamber or otherwise, but does not include premises used for the sale by retail of such dairy produce. But if a retailer stores butter in quantity on this premises, such store could not be included as a retail section, and therefore would have to be registered.

Anyone keeping dairy produce where it may deteriorate owing to heat, bad smell or the proximity of unclean matter is liable to a penalty not exceeding L. 20 This applies more particularly to cream and butter which are more sensitive to their surroundings than cheese.

The butter merchants of Sydney have decided to store their butter in a cold store during the night.

1219 – **Investigations on the Protease of Milk Bacteria.** — Swiatopelk-Zawadski, in *Zeitschrift für Untersuchung der Nahrungs und Genussmittel, sowie der Gebrauchsgegenstände*, Vol. 32, No. 4, pp. 161-170. Münster i. W., August 15, 1916.

A series of very careful experiments were carried out on the production of protease by milk bacteria. The results are discussed and compared with those obtained by other investigators, and the following conclusions are drawn:

1) Pure fresh milk contains no peptone.

2) True lactic acid bacteria do not dissolve casein within a period of 7 days, *i. e.* they do not produce protease.

3) The presence of peptone in a self coagulated milk can only be attributed to the presence of peptonising bacteria.

4) The decomposition of casein and other albuminoid substances only occurs through the agency of bacteria.

5) The rate at which the albuminoids are converted to peptones increases with the temperature up to 44° C.

6) Proteolytic ferments may be produced by aerobic and anaerobic bacteria, both spore-forming and non spore-forming.

In the present experiments the most active aerobic bacteria were *Bacillus pyocyaneus* (after 6 hours), *Bac. prodigiosus* (after 18 hours) and *Bac. coli commune* (after 24 hours); and amongst the spore-formers *Bac. subtilis* (after 6 hours) and *Bac. mesentericus vulgatus* (after 18 hours).

The most active anaerobic bacterium was the spore-forming *Paraplectum foetidum* (after 24 hours).

7) The amount of peptone produced and the rate at which it is formed vary not only with the different species but often with different strains of the same species (*e. g. B. subtilis*).

8) The hydrolysis of casein can take place independently of the coagulation of milk, which does not even assist the process.

9) In the present experiment neither the amount of peptone produced nor its rate of production by aerobic bacteria was affected by the presence of other bacteria in the medium. At about 12° C. the activity of protease is always somewhat retarded. Sterilized milk inoculated with pure cultures of various organisms and incubated at 12° C. already contained peptone after 8 hours with *B. pyocyaneus* and *B. subtilis* and after anything up to 14 days with *B. coli commune, B. prodigiosus, B. paraplectum foetidum, B. mesentericus vulgatus* or in other words the presence of *B. acidi lactici* in the unsterilized milk had no appreciable effect on the results.

1220 - **The Supply of Rennet for Cheese Making in Italy** (1). — I. Besana, C., (The lack of coagulating ferments for the cheese factories). — II. Fascetti, G., (How to supply the necessary amount of rennet.) in *Le Stazioni sperimentali agrarie italiane*, Vol. XLIX, No. 1, pp. 10-12 and 13-16. Modena, 1916.

In Italy the slaughter of calves weighing less than 400 lbs. is prohibited. Consequently the stomachs of calves nourished wholly on milk or in other words those best adapted to the manufacture of rennet are excluded from the market. At the present time, imports of dried stomachs from European countries have almost ceased and it seems uncertain how far it will be possible to obtain the material from elsewhere. Normally 45-50 tons of rennet are used annually in the Italian cheese factories and of this about one half is imported abroad. Under these circumstances it is essential that Italy should take steps to prevent a shortage of rennet in the country. To this end it is suggested:

1) That the available calves stomachs be more completely extracted and that the use of lambs' and kids' stomachs be encouraged and developed. The latter are already employed in the manufacture of « pecorino » cheese, but only to a very slight extent.

2) That the preparation of a vegetable rennet from the capituli of the cardoon (*Cynara Cardunculus* ) be encouraged. This plant grows wild in central and southern Italy and might well be cultivated for rennet production.

3) That an attempt be made to produce coagulating enzymes from bacterial cultures.

1221 - **The Abnormal Composition of Fat in a Pig, Fed on Maize.** — Rievel, in *Zeitschrift für Untersuchung der Nahrungs und Genussmittel, sowie der Gebrauchsgegenstände*, Vol. 132, N°. 4 pp. 178-181. Munster i W., August 15, 1916.

The fat on the carcase of a seven months old pig was found to be quite abnormal. It was firm, opaque, almost dead white and chalky when freshly

(1) See *B.* Feb. 1916, No. 233. (*Ed.*).

cut. On being melted out it solidified very quickly forming a greyish lard with a very smooth even surface which did not show the usual depression in the middle with concentric rings radiating outwards. The lard was hard and cut like paraffin. Its constants were determined and compared with those of other fats as follows:

| | Abnormal lard | Normal lard | Mutton fat | Venison fat |
|---|---|---|---|---|
| Solidifying point °C | 46.9 | 37.2–39.8 | 34.45 | 40.05 |
| Melting point °C | 56.5 | 26.5–28.6 | 49.25 | 51.50 |
| Solubility per 100 parts chloroform at 17°C | 80 | 100 | 71 | 71 |
| Refractive index at 40°C | 43.9 | 50.6–50.9 | 46.85 | 44.75 |
| Refractive index of chloroform solution at 17°C | 41.9 | 46.1–47.5 | 47.45 | 40.55 |
| Saponification value | 159.9 | 196–198 | 196 | — |
| Reichert-Meisel value | 2.5 | 0.3–0.9 | 0.25 | — |
| Iodine value | 23.6 | 46–47 | 40 | — |
| Ash per cent | 1.24 | traces | — | — |

The fat differed so markedly from ordinary lard that it could not be designated as such. It more closely resembled mutton or venison fat. The writer suggests that the abnormal character of the lard was due to the fact that the animal had been fed for a long time on damaged maize. As a rule a maize diet causes the production of a soft and oily fat but in the present case opposite effects were observed and these can only be explained on the assumption that the prolonged feeding with the damaged maize resulted in grave metabolic disturbances in the pig and that these interfered with the deposition of fat.

1222 – **The World's Sheep and their Wool with Special Reference to the Production in Australasia.** — *Dalgety's Review, Annual Wool Number*, Year XXIV, N°. 4, pp. 36-126. Sydney, July, 1, 1916.

The National Association of Wool Manufacturers in America has issued two tables in which are given the latest figures for the total number of sheep in the world, and for the world's production of wool. They cannot of course be taken as exact statements for in some cases the figures refer to pre-war periods; they are merely meant give an approximate idea of the situation. The tables are as follows:

TABLE I. — *Distribution of sheep in the world.*

| Country | Year | Number |
|---|---|---|
| *North America:* | | |
| United States Continental | 1915 | 49 956 000 |
| Hawaii | » | 76 719 |
| Porto Rico | » | 6 363 |
| Alaska | » | 199 |
| Total, United States | | 50 039 281 |

| | | |
|---|---|---|
| Canada | 1915 | 2 038 662 |
| Newfoundland | — | 97 597 |
| Mexico | 1902 | 3 424 430 |
| Central America | — | 124 044 |
| Cuba | — | 9 982 |
| British West Indies | — | 27 980 |
| Dutch West Indies | — | 22 643 |
| Guadeloupe | — | 11 731 |
| | | 5 757 069 |
| Total, North America | | 55 796 350 |
| *South America:* | | |
| Argentina | 1912 | 83 545 931 |
| Brazil | 1913 | 10 653 000 |
| Bolivia | 1910 | 1 454 729 |
| Chili | 1914 | 4 602 317 |
| Colombia | — | 746 000 |
| Uruguay | 1908 | 26 286 296 |
| Falkland Islands | — | 711 000 |
| Other countries | — | 407 000 |
| Total, South America | | 128 406 273 |
| *Europe:* | | |
| Austria-Hungary | 1910-13 | 12 337 867 |
| Belgium | — | 235 722 |
| Bulgaria | 1910 | 8 632 388 |
| Denmark | — | 1 319 197 |
| Finland | | 1 309 000 |
| France | 1915 | 13 483 189 |
| Germany | 1914 | 5 451 570 |
| Greece | — | 4 000 000 |
| Italy | 1908 | 11 162 926 |
| Netherlands | — | 842 000 |
| Norway | — | 1 393 000 |
| Portugal | 1906 | 3 077 978 |
| Roumania | 1911 | 5 269 493 |
| Russia in Europe | 1911 | 46 381 000 |
| Saxony | — | 58 185 |
| Serbia | 1910 | 3 818 997 |
| Spain | 1913 | 16 441 407 |
| Sweden | 1911 | 946 000 |
| Switzerland | 1911 | 160 000 |
| Turkey | 1910 | 21 190 000 |
| United Kingdom | 1915 | 27 552 136 |
| Other countries | — | 20 000 |
| Total, Europe | | 185 077 065 |
| *Asia:* | | |
| British India: | | |
| British provinces | 1914 | 23 091 955 |
| Native States | » | 8 129 000 |
| Total, India | | 31 220 955 |

| | | |
|---|---|---|
| Ceylon | 1912 | 91 000 |
| Cyprus | 1912 | 256 000 |
| Japan | 1912 | 3 357 |
| Philippine Islands | 1913 | 103 000 |
| Russia in Asia | 1911 | 34 493 000 |
| Turkey in Asia | 1912 | 27 094 678 |
| Other countries | — | 60 000 |
| Total, Asia excluding India | | 62 101 035 |
| *Africa:* | | |
| Algeria | 1912 | 8 338 023 |
| British East Africa | — | 6 500 000 |
| German East Africa | 1913 | 6 439 647 |
| German West Africa | 1912 | 499 000 |
| Madagascar | 1911 | 352 000 |
| Rhodesia | 1911 | 300 000 |
| Soudan (Anglo-Egyptian) | 1909 | 830 000 |
| Tunis | 1912 | 767 000 |
| Uganda | 1914 | 542 000 |
| Cape of Good Hope | — | |
| Natal | — | |
| Orange Free State | — | |
| Transvaal | 1913 | 35 710 843 |
| Other countries | — | 4 130 335 |
| Total, Africa | | 64 408 848 |
| *Oceania:* | | |
| Australia | 1915 | 82 011 606 |
| New Zealand | 1915 | 24 465 526 |
| Total, Australasia | | 106 477 132 |
| Other countries | | 10 000 |
| Total, Oceania | | 106 487 132 |
| Total, World | | **633 491 658** |

The remarks made in the introduction apply with even more force to the world's wool production. Reliable statistics are available for the United States, Australasia and British South Africa. In other countries the quantities reported the previous year are used, and in some cases where the report of the number of sheep has been materially altered, the quantity records has been modified accordingly. There is an apparent anomaly in the increase in the number of Argentine sheep reported and the steady decrease of wool exports. In 1907 the Argentine census reported 67 200 000 sheep ; more recent estimates increase the number of Argentine sheep to 83 545.931. At the same time the wool exports have decreased from 178 000 metric tons in 1907-1908 to 120 000 in 1913-1914. The National Association puts forward the suggestion that the census report included shearing sheep only and made no account of lambs, and that later the reports included both sheep and lambs. In the absence of official Ar-

gentine returns the sheep figures are presented with this suggestion. The wool production of the world is given below.

TABLE II. — *Wool production of the world.*

| Country | Lbs. of wool |
|---|---|
| *North America:* | |
| United States | 288 777 000 |
| British Provinces | 11 210 000 |
| Mexico | 7 000 000 |
| Total, North America | 306 987 000 |
| *Central America and West Indies* | 750 000 |
| *South America:* | |
| Argentine | 264 500 000 |
| Brazil | 35 000 000 |
| Chili | 17 000 000 |
| Peru | 9 420 707 |
| Falkland Islands | 3 200 000 |
| Uruguay | 143 293 000 |
| Other countries | 5 000 000 |
| Total, South America | 777 413 707 |
| *Europe:* | |
| Austria-Ungary | 41 600 000 |
| France | 75 000 000 |
| Greece | 16 000 000 |
| Germany | 25 600 000 |
| Portugal | 10 000 000 |
| Italy | 21 500 000 |
| Russia in Europe | 320 000 000 |
| Spain | 52 000 000 |
| Turkey and Balkan States | 90 500 000 |
| United Kingdom | 121 200 043 |
| Other countries | 30 000 000 |
| Total, Europe | 803 400 043 |
| *Asia:* | |
| British India | 60 000 000 |
| China | 50 000 000 |
| Persia | 12 146 000 |
| Russia in Asia | 60 000 000 |
| Turkey in Asia | 90 000 000 |
| Other countries | 1 000 000 |
| Total, Asia | 273 146 000 |
| *Africa:* | |
| Algeria | 33 184 000 |
| British Africa | 157 761 470 |
| Tunis | 3 735 000 |
| Other countries | 13 000 000 |
| Total, Africa | 207 680 470 |

| | |
|---|---|
| *Oceania :* | |
| Australia and Tasmania | 569 775 000 |
| New Zealand | 197 866 914 |
| | 767 841 914 |
| Other countries | 100 000 |
| Total, Oceania | 767 141 914 |
| Total, World | **2 836 519 000** |

Summarising, the various parts of the world in order of production are as follows :

| | Lbs. of wool |
|---|---|
| Europe | 803 400 043 |
| America | 785 150 707 |
| Oceania | 767 141 914 |
| Asia | 273 146 000 |
| Africa | 207 680 470 |

*Australasian production of wool.* — The oversea export of wool during the statistical year ended June 30 amounted to 1 619 259 bales from the Australian Commonwealth and 510 656 bales from New Zealand, the for mer being an increase of 43 571 bales as compared with the preceding season and the latter a decrease of 51 358 bales. These figures do not, however, provide anything like a true index of the state of production for the past season, because of the heavy carry-over of 1914-1915 clip wools (approximately 200.000 bales) to the 1915-1916 season while there remained unshipped on June 30 about 65 000 bales. The actual production of wool in Australia for export during the 1915-1916 season can therefore be set down as 1 484 000 bales as compared with 1 775 000 bales for 1914-1915. For New Zealand the corresponding figures are 510 656 and 562 014 respectively. Adding together the Commonwealth and New Zealand figures, a total Australasian production of 1 994 656 bales is obtained as compared with 2 337 014 bales for the previouus season (or a decrease of 342 014 bales). Taking the comparison back two seasons, the figures show a falling off in production for export of 532.807 bales since 1913-1914.

The 1 994 656 bales produced averaged 3 227 lbs. in weight, so that the actual wool output for 1915-1916 was 654 032 880 lbs. The distribution of the output is given in Table III. As special features of the season, it may be pointed out that America, Italy and Japan purchased large quantities of wool while the United Kingdom only took 41 per cent of the total sales as against 64 per cent the previous year. The financial statements of the sales in the different markets were as follows :

| Market | No. of bales | Value £ |
|---|---|---|
| Sydney | 707 969 | 10 429 770 |
| Melbourne and Geelong | 349 984 | 5 632 152 |
| Adelaide | 115 314 | 1 525 972 |
| Freemantle | 1 459 | 16 527 |
| Brisbane | 246 376 | 4 279 498 |
| Tasmania | 22 016 | 303 643 |
| New Zealand | 364 861 | 7 715 970 |
| Australasia | 1 807 979 | 29 903 532 |

Average price per bale £16 10*s* 10*d* (1).

The gross revenue as shown above exceeded that of 1914-1915 by ten million sterling.

The 1914-1915 clip was characterised by a rise in the proportion of crossbred to merino wool and in this connection it is interesting to contrast the clips over a period of 5 years. At Melbourne in 1911-1912, 56 per cent of the wool sold consisted of merino, the rest being crossbred, but in 1915-1916 the percentage had been reduced to 48. At Geelong over the same period the reduction was smaller *i. e.* from 51 to 49 per cent. The increasing amount of crossbred wool on the market is attributed to the growth of the frozen meat trade which is gradually causing the pure merino flocks to be replaced by general purpose sheep *i. e.* sheep which are more suitable for the production of mutton though their fleece may not be quite so fine as that of the merino. Nevertheless in Queensland the merino is still likely to hold its own, as the recent drought there has demonstrated clearly the special hardiness of the Peppin and South Australian types and has made owners less anxious to try experimental crosses with English breeds. With regard to the demand for the two classes of wool, the war has caused an unprecedented run upon the coarser kinds to supply the army clothing departments. America has on the other hand been a keen buyer of the finer types.

A comparison of the average weight of fleeces for the last three seasons is given below :

| | No. of fleeces per bale | Average weight of bale |
|---|---|---|
| 1913-1914 | 41.56 | 327.2 |
| 1914-1915 | 43.97 | 329.1 |
| 1915-1916 | 44.31 | 322.7 |

These figures are not altogether a true indication of how the sheep are cutting as the weight of the bales varies and shows a tendency to become lighter. From the above figures the mean yield per sheep for 1915-1916 and 1914-1915 was 7.28 and 7.41 lbs. respectively.

The top prices made in any one year on the Australian markets have

(1) Corresponding figures for 1913-1914 were : 2 527 463 bales for a gross value of £33 478 353 or £13 4*s* 11*d* per bale.

been collected in Table IV and show how the figures for 1915-1916 completely put all previous records in the shade. Table V indicates the course of quotations for the various qualities since 1910.

There is every indication that the clip for the present season will be larger than that for 1915-1916. The flocks are everywhere in good condition and the owners look forward to a yield of heavy fleeces.

TABLE III. — *Destination of exports of Australasian wool* (1914-1915 *and* 1915-1916).

| Destination | 1915-1916 | | 1914-1915 | |
|---|---|---|---|---|
| | No. of bales | Per cent of total export | No. of bales | Per cent of total export |
| United Kingdom | 742 178 | 41 | 983 355 | 64 |
| France | 57 345 | 3 | 58 706 | 4 |
| Belgium and Netherlends | — | — | 5 459 | — |
| Germany and Austria | — | — | 8 439 | 1 |
| Italy and Switzerland | 166 916 | 10 | 68 436 | 4 |
| Russia, Norway and Sweden | 7 422 | — | 1 466 | — |
| United State and Canada | 564 433 | 31 | 234 896 | 15 |
| Japan, China and India | 113 611 | 6 | 81 890 | 9 |
| Local manufactures | 156 074 | 9 | 102 152 | 7 |
| | 1 807 979 | | 1 544 799 | |

TABLE IV. — *Top prices made for wool in the Australasian markets* (*pence per lb.*)

| Year | Greasy fleece | | Scoured fleece | |
|---|---|---|---|---|
| | Merino | Crossbred | Merino | Crossbred |
| 1915–1916 | 24 3/4 | 23 1/4 | 44 1/2 | 27 |
| 1914–1915 | 18 3/4 | 18 | 28 | 22 1/4 |
| 1913–1914 | 20 1/4 | 15 | 28 | 20 3/4 |
| 1912–1913 | 19 1/4 | 15 3/4 | 26 1/2 | 20 1/2 |
| 1911–1912 | 18 1/2 | 14 3/4 | 24 3/4 | 17 3/4 |
| 1910–1911 | 18 1/4 | 15 1/4 | 24 1/2 | 20 |
| 1909–1910 | 21 | 18 1/4 | 25 1/4 | 20 1/2 |
| 1908-1909 | 19 | 15 1/2 | 23 3/4 | 16 1/2 |
| 1907–1908 | 20 1/2 | 17 1/2 | 27 1/4 | 23 1/4 |
| 1906–1907 | 18 1/4 | 17 1/2 | 25 | 22 1/2 |

TABLE V. — *Quotations for tops on the Australasian markets at June, 30th (pence per lb.).*

| Counts (1) | 1909 | 1910 | 1911 | 1912 | 1913 | 1915 | 1916 |
|---|---|---|---|---|---|---|---|
| 70's (fine quality merino) . . . . | 28 1/2 | 29 1/2 | 28 | 27 1/2 | 31 1/4 | 32 1/2 | 46 |
| Super 60's (good merino) . . . . . | 26 1/2 | 28 | 26 1/2 | 25 1/2 | 29 1/4 | 30 1/2 | 44 1/2 |
| Common 60's (ordinary merino) . . | 25 1/2 | 27 | 25 1/2 | 25 | 29 | 30 | 43 |
| 58's (coarse merino fine comeback . | 24 | 25 3/4 | 23 1/2 | 22 1/2 | 26 | 26 1/2 | 40 |
| 56's (c'b'k fine xb.) . . . . . | 21 1/2 | 23 1/2 | 21 1/2 | 20 1/4 | 23 3/4 | 23 3/4 | 36 1/2 |
| 50's (fine quality xb.) . . . . . | 18 1/4 | 20 3/ | 18 1/2 | 17 3/4 | 21 1/4 | 20 1/2 | 33 1/2 |
| 46's (medium quality xb.) . . . . | 15 | 16 3/4 | 15 1/4 | 14 1/2 | 17 1/2 | 17 1/4 | 28 |
| 44's (rather coarse xb.). . . . . | 14 | 15 3/4 | 14 3/4 | 14 | 16 1/2 | 16 3/4 | 27 |
| 40's (coarse quality xb.) . . . . . | 12 3/4 | 14 1/4 | 14 1/4 | 13 1/2 | 16 1/4 | 16 1/2 | 26 |
| 36's (Lincoln and Leicester) . . . | 12 | 13 1/4 | 13 1/2 | 13 1/4 | 16 | 16 1/4 | 25 |

(1) The « count » number was originally used to indicate the number of hanks of 560 yds. per *lb.* of worsted yarn. For example :

*lb.* of 40's worsted yarn contained 40 × 560 = 22400 yds. of worsted
» 60's » » » 60 × 560 = 33600 » »

But in actual practice the count number represents the fineness ot the fibres rather than the yield of hanks per *lb.* In fact the yarn may be classed as 60's for the thickness of its yarn even if it only yiel ded 50 hanks per lb. on account of the lack of length and uniformity in the fibres.

1223 – **New and Quick Method of Determining the Age of Eggs.** — GROSSFELD, in *Molkerei-Zeitung*, Year 30, N° 33, pp. 515-517. Hildesheim, August 18, 1916.

A new method has been devised for estimating the age of eggs. It is based on the fact that a new laid egg is heavier than water and that it gradually loses weight as its age advances. The weight of an average sized fresh egg in water is 4.3 gms. and decreases at the rate of 0.6 gm. per week, so that after about seven weeks the egg is of exactly the same density as water and then its weight gradually passes into minus values, as the egg reaches advanced stages of preservation.

By means of a simple areometer, the weight of the egg in water can be determined very quickly. The instrument is made by HUGERSHOFF, GUERBER AND CO., Leipzig and consists of a graduated tube with a metal basket at its base. Having placed the egg in the basket, the whole instrument is immersed in the coldest water available and the weight of the egg in water as well as its age in weeks can be read off directly from the graduations. The whole operation only takes a few seconds so that a large number of eggs can be tested in a short time.

Though the instrument is calibrated for an egg weighing 54.3 gms. and occupying a volume of 50 cc., *i. e.* for an average sized egg, the readings are sufficiently correct for practical purposes with all but very small

or very large eggs. Where however a greater degree of accuracy is required the error due to the size of the egg can be eliminated as follows : the weight of the egg in water is divided by its weight in air and multiplied by 100. The resulting figure is about 8 for a new laid egg and decreases at the rate of 1 per week as the age of the egg advances. For example :

an egg weighing 2 gms. in water and 60 gms. in air would be $8 - \frac{2 \times 100}{60} = 8 - 3.3 =$ between 4 and 5 weeks old.

The areometer also affords an easier means of determining the specific gravity of eggs than by the use of saline solutions. With the figures given above,

$$\text{Specific gravity of egg} = \frac{\text{weight in air}}{\text{weight in air} - \text{weight in water}}$$

$$\frac{60}{60 - 2}$$

$$= 1.034.$$

1224 – **A Study of the Preparation of Frozen and Dried Eggs.** — PENNINGTON M. E., JENKINS M. K., STOCKING W. A., et al. in *United States Department of Agriculture, Bulletin* No. 224, pp. 1-99. Washington, April 28, 1916.

In Bulletin No. 51 (*U. S. Dep. of Agr.*) a report has already been made of the various types of eggs used in the preparation of frozen and dried eggs in the egg-producing districts of the United States. It was shown that in order to obtain the best results a certain proportion of eggs should be stored as « liquid eggs », *i. e.* without their shells. A study of the conditions prevailing in the egg-breaking establishments was next undertaken in cooperation with the factories themselves, the results of which are set out in the present paper. The body of the bulletin gives an outline of the work done and the conclusions which should be of general interest to all connected with the industry. In the appendix are given details of the experiments which may be of use to managers of factories and to chemists and bacteriologists engaged in food investigations.

This report is based on observations made in establishments scattered between northwestern Iowa and central Kansas, during the seasons 1911 and 1912. Tables I and II give a general summary of the results of the bacteriological and chemical examinations of various grades of liquid eggs in three of the factories (D, E, and F,) The grades of eggs mentioned are :

| | |
|---|---|
| « whole eggs » | = eggs merely deprived of their shells. |
| « mixed eggs » | = a product prepared by adding yolks to whole eggs. |
| « leakers » | = eggs with shell and inner membrane broken. |
| « soft eggs » | = eggs whose yolk appears whole before the candle but which breaks when opened. |
| « second grade eggs » | = a product prepared from « drip » and incipient forms of deteriorated eggs. |
| « tanners' eggs » | = is a product made from the rejects of the candling and breaking rooms excluding eggs with a bad odour. It is used for tanning leather. |
| « drip » | = is the liquid egg, mostly white, which collects in the bottom of the breaking tray. |

TABLE I. — *Bacterial counts on liquid eggs.*

| Description of sample | No. of samples | Samples with over 5 000 000 bacteria per gm. | No. of organisms per gm. | | |
|---|---|---|---|---|---|
| | | | Average | Minimum | Maximum |
| | | per cent | | | |
| Whites | 39 | 2.6 | 350 000 | 100 | 7 500 000 |
| Yolks | 54 | 5.6 | 530 000 | 200 | 7 500 000 |
| Whole eggs | 47 | 21.3 | 2 700 000 | 340 000 | 11 000 000 |
| Mixed eggs from D house. | 46 | 0 | 1 000 000 | 5 100 | 3 300 000 |
| » » » F » | 12 | 8.3 | 1 700 000 | 470 000 | 6 800 000 |
| Leaking eggs | 53 | 5.9 | 1 300 000 | 500 | 6 000 000 |
| Soft eggs | 13 | 46.1 | 20 000 000 | 130 000 | 80 000 000 |
| Second-grade eggs | 14 | 92.8 | 35 000 000 | 4 200 000 | 92 000 000 |
| Tanners' eggs | 10 | 100 | 76 000 000 | 31 000 000 | 150 000 000 |

TABLE II. — *Chemical tests on liquid eggs.*

| Description of sample | No. of samples | Ammoniacal nitrogen | | | | | | Percentage of moisture | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Per 100 parts wet weight | | | Per 100 parts dry weight | | | | | |
| | | Average | Min. | Max. | Average | Min. | Max. | Average | Min. | Max. |
| Whites | 13 | 0.0004 | 0.0002 | 0.0006 | 0.0031 | 0.0016 | 0.0049 | 87.37 | 86.96 | 88.31 |
| Yolks | 23 | 0.0032 | 0.0024 | 0.0045 | 0.0076 | 0.0054 | 0.0103 | 57.88 | 53.64 | 64.06 |
| Sugared yolks | 7 | 0.0030 | 0.0028 | 0.0033 | 0.0062 | 0.0058 | 0.0067 | 51.12 | 49.89 | 53.07 |
| Whole eggs | 43 | 0.0021 | 0.0016 | 0.0024 | 0.0074 | 0.0054 | 0.0087 | 72.33 | 70.23 | 74.17 |
| Mixed eggs from D house | 34 | 0.0020 | 0.0014 | 0.0025 | 0.0067 | 0.0046 | 0.0082 | 68.88 | 68.33 | 71.43 |
| Mixed eggs from F house | 10 | 0.0023 | 0.0017 | 0.0027 | 0.0071 | 0.0053 | 0.0082 | 68.06 | 67.00 | 70.81 |
| Leaking eggs | 37 | 0.0020 | 0.0013 | 0.0028 | 0.0065 | 0.0047 | 0.0080 | 69.63 | 64.12 | 72.83 |
| Soft eggs | 11 | 0.0023 | 0.0018 | 0.0031 | 0.0080 | 0.0066 | 0.0098 | 71.24 | 67.04 | 72.99 |
| Second-grade eggs and drippings | 14 | 0.0024 | 0.0008 | 0.0040 | 0.0108 | 0.0052 | 0.0182 | 78.20 | 71.79 | 84.60 |
| Tanners' eggs | 9 | 0.0041 | 0.0021 | 0.0069 | 0.0133 | 0.0074 | 0.0219 | 69.98 | 65.06 | 71.89 |

The average number of bacteria per gm. in the whites was 350.000, in the yolk 530 000 and in the whole and mixed eggs 1 800 000. The average amount of ammoniacal nitrogen was 0.0031 per cent of the dry matter in the whites, 0.0076 per cent in the yolks and 0.0074 per cent in the whole eggs. A comparison of these results shows that the average count of the whites is about half that of the yolks and that the latter contained approximately one third as many bacteria as the whole and mixed egg. The antiseptic action of the white may explain its lower bacterial content as compared with that of the yolks, whole eggs and mixed eggs. It may

be that the presence of soft eggs in the whole and mixed eggs offers also an explanation of their higher bacterial content.

It is interesting to note that the average count of the product prepared from leaking eggs is not different from that of whole and mixed eggs. The average count of the former was 1.300.000 and for the latter 1.800.000. The amount of chemical decomposition was no greater in the leaking eggs than in the whole and mixed eggs.

The product prepared from soft eggs graded as fit for food purposes contained decidedly more bacteria than the whole or mixed egg, but the amounts of ammoniacal nitrogen in the two were not so very far apart. The average number of organisms in the soft eggs numbered 20 000 000 per gram, as compared with 1 800 000 in the whole and mixed egg, whereas the percentage of loosely bound nitrogen averaged 0.0080 in the former and 0.0074 in the latter. The bacteria in the soft eggs were not present in sufficient numbers or for a sufficient length of time to affect a decomposition of the egg material. On the other hand the second grade frozen egg prepared from « beginning sours », (*i. e.* eggs with light-green whites and the tanners' eggs were not only heavily infected but were decomposed. The average number of bacteria in the former was 35 000 000 per gm. and in the latter 76 000 000. The amount of ammoniacal nitrogen was 0.0108 per cent in the second-grade egg and 0.0133 in the tanners' eggs. The comparative data, together with the practical observations of the eggs used in the former product, show very conclusively that second-grade canned or dried eggs are unfit for food purposes.

As the houses under observation during 1912 were three of the largest producers of canned and dried eggs in the United States, it is instructive to compare the quality of their output as indicated by its bacterial content with that offered for sale for food during the two years previous to the investigation. STILES and BATES (*Bureau of Chemistry, U. S. Dep. of Agr. Bulletin* No. 158) found in a study of 312 samples of frozen eggs collected from different sources during the years 1909 to 1911, inclusive, that 58.3 per cent contained over 10 000 000 bacteria per gram. Of 216 samples of liquid eggs obtained from the cooperating houses during this investigation in 1912, only 1.4 per cent were found to contain over 10 000 000 per gram. The maximum count in the three houses in 1912 was 11 000 000 per gram, while the maximum found by Stiles and Bates was 1 180 000 000.

The difference in the bacterial count of the samples of dried eggs was equally as marked. Stiles and Bates found that 83.3 per cent of the samples purchased on the open market contained over 10 000 000 per gram. Only 6.3 per cent of 46 samples taken in E house contained over this number, while in F house 55.3 per cent of the samples were in excess of 10 000 000. The maximum number per gram found in the samples of dried eggs taken in 1912 was 20 000 000 for E house and 200 000 000 for F house, and in the samples collected between 1909 and 1911 by Stiles and Bates 210 000 000 It is known in the case of F house that the raw material was of good quality and that the bacteria increased during desiccation.

The samples studied by Stiles and Bates represented not only frozen

and dried eggs prepared from good eggs by the best methods known at the time, but also products made from unfit raw material. These comparative data speak well for the quality of the product prepared by the new methods in the three houses under investigation.

## CONCLUSIONS.

1) Eggs commonly used for breaking stock by reputable firms are small and oversized eggs, dirty and cracked eggs, and shrunken eggs.

2) In order to check deterioration, the eggs should be held in chilled surroundings before and during the process of candling, breaking, and mixing preparatory to freezing or drying. The temperature of the store room should not be higher than 0° to 1°C., that of the candling room 10° to 13°C., that of the breaking room 15° to 18°C.

3) All eggs, even during the spring months, should be candled previous to breaking.

4) In order to insure well candled eggs going to the breaking room, the system of candling should be such that the work of the individual candlers is checked.

5) In order to prevent waste, the eggs difficult to grade should be set aside by the regular candlers to be recandled by an expert.

6) All eggs used in the preparation of frozen and dried eggs should be graded out of the shell as well as by the candle, because certain heavily infected eggs, such as sour eggs and eggs with green whites, can only be detected when broken.

7) In order to insure a good product, bacterial cleanliness and careful grading must be obtained during the process of preparation.

8) The fingers of the breakers should be kept dry and clean.

9) In order to prevent waste and to insure good grading, not more than three eggs should be broken into a cup before emptying.

10) Good eggs should not be saved when a bad egg has been broken into a cup with them.

11) White and yolk are contaminated less by the mechanical than the shell method of separation. Only clean eggs should be separated by the latter process.

12) The percentage of « rots » rejected on candling and the number of organisms in the liquid egg increase as the season advances.

13) Canned eggs with the majority of samples having counts of less than 5 000 000 bacteria per gram, and with 100 000 *B. coli* or less can be prepared in the producing section from regular breaking stock, provided strict cleanliness and careful grading have been observed. The ammoniacal nitrogen will very seldom be over 0.0087 per cent of dry matter.

14) A second-grade frozen product prepared from eggs showing incipient decomposition to the senses, such as « beginning sours » and eggs with green whites are not only heavily infected but chemically decomposed. These eggs are unfit for food purposes.

15) Only two grades of canned eggs should be prepared when grading eggs out of the shell, namely, food egg and tanners' egg.

16) Leaking eggs handled on special trays between candling and breaking room and graded carefully are as fit for breaking as regular breaking stock.

17) Tanners' egg contains markedly larger numbers of bacteria and larger amounts of ammoniacal nitrogen than does food egg.

18) The control of the supply of air to drying belts to prevent saturation from the liquid egg is an important factor in preventing multiplication of bacteria in the product during the process of desiccation.

19) The amount of ammoniacal nitrogen in desiccated egg is not a reliable index to the quality of the raw material from which it is prepared, because this substance is volatilized unevenly during the process of desiccation.

20) The following eggs should be discarded during grading : Black, white, mixed and sour « rots », eggs with green whites, eggs with stuck yolks, musty eggs, mouldy eggs, « blood rings », eggs containing diffuse blood, and eggs with abnormal odour.

# PLANT DISEASES

## DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1225 - **Mottle-Leaf of Citrus Trees in Relation to Soil Conditions.** — LYMAN, J., BRIGGS J. C. A., and Mc LANE J. W., in *Journal of Agricultural Research*, Vol. VI, No 19, pp. 721-739, Pl. XCVII. Washington, D. C., 1916.

Mottle-leaf of Citrus trees is characterised by the disappearance of the chlorophyll from parts of the leaf beginning at the points which are furthest away from the mid-rib and the larger veins. As the alteration progresses the yellowish spots increase in size, and finally unite, until the only remaining chlorophyll is confined to narrow areas along the veins. In advanced stages there is a marked decrease in the size, quality and yield of the fruit. No organism has as yet proved to be associated with this condition, but it is generally stated that the nematode *Tylenchulus semipenetrans* Cobb (1) is widely distributed in districts infected with mottle-lead.

Mottle-leaf is found in most Citrus fruit plantations in California, but it is more prevalent in some districts than in others. All the Citrus fruits grown in California are affected, including the Washington Navel, Thompson Improved Navel, and Valencia orange, grapefruit, tangerine and lemon.

Other conditions being equal, the buds grafted on to *C. aurantium* are more susceptible than those grafted on to *C. sinensis*; in a mixed grove of Washington Navel and Valencia oranges both varieties were equally attacked.

Orchards manured with organic substances, such as stable manure or clover crops, usually did better than those treated with chemical fertilisers. In the latter case the changes induced are always more extensive than when nitrate of soda alone is employed.

The experiments in question indicate that the origin of the disease must be sought in the conditions of growth and more especially in the

(1) See *B.* July 1915, No. 776. (*Ed.*).

chemical composition of the soil. The conclusions are based upon a field and laboratory study of 130 orange groves and 45 lemon groves mainly situated in Riverside and San Bernardino Counties, California. The percentage of mottled leaves was determined by examining 10 to 12 typical trees in each grove. A soil sample 3 feet in depth was taken near each tree, each foot sample being kept separately. These samples were analysed, for humus, organic carbon, mineral carbonates, bicarbonates and total nitrogen. The most striking results are shown in Tables I and II.

The moisture equivalent is a measure of the moisture retentiveness of a soil, and is numerically equal to the percentage of moisture which a given soil is able to retain in opposition to a centrifugal force 1000 times that of gravity. The finer the soil particles the greater is the moisture equivalent.

The following facts can be gleaned from tables I and II:

TABLE I. — *Analysis of orange grove soils, grouped according to percentage of mottled leaves, each group containing about 20 groves.*

| Group | Percentage of — | | | | | Ratio of — | | | | Moisture equivalent | Mottled leaves |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Humus | Total nitrogen | Organic carbon | Mineral carbonates | Mineral bicarbonates | Humus to lime | Carbon to humus | Nitrogen to humus | Nitrogen to carbon | | |
| 1 | 0.119 | 0.036 | 0.237 | 0.069 | 0.023 | 1.72 | 2.50 | 0.303 | 0.152 | 11.3 | 88 |
| 2 | 0.142 | 0.036 | 0.256 | 0.066 | 0.024 | 2.15 | 1.54 | 0.254 | 0.141 | 12.4 | 64 |
| 3 | 0.170 | 0.039 | 0.254 | 0.093 | 0.026 | 1.83 | 1.67 | 0.229 | 0.154 | 11.6 | 43 |
| 4 | 0.165 | 0.039 | 0.255 | 0.080 | 0.027 | 2.06 | 1.65 | 0.237 | 0.153 | 12.6 | 19 |
| 5 | 0.244 | 0.039 | 0.261 | 0.068 | 0.020 | 3.59 | 1.93 | 0.159 | 0.149 | 11.9 | 8 |
| 6 | 0.204 | 0.038 | 0.263 | 0.079 | 0.028 | 2.58 | 1.78 | 0.186 | 0.144 | 12.8 | 1 |

TABLE II. — *Analyses of lemon grove soils, grouped according to percentage of mottled leaves, each group including 8 groves.*

| Group | Percentage of — | | | | | Ratio of — | | | | Moisture equivalent | Mottled leaves |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Humus | Total nitrogen | Organic carbon | Mineral carbonates | Mineral bicarbonates | Humus to lime | Carbon to humus | Nitrogen to humus | Nitrogen to carbon | | |
| 1 | 0.066 | 0.036 | 0.241 | 0.062 | 0.023 | 1.06 | 2.74 | 0.545 | 0.149 | 10.1 | 92 |
| 2 | 0.081 | 0.033 | 0.258 | 0.050 | 0.024 | 1.64 | 3.18 | 0.407 | 0.128 | 10.6 | 87 |
| 3 | 0.087 | 0.037 | 0.265 | 0.073 | 0.029 | 1.19 | 3.05 | 0.425 | 0.139 | 11.8 | 82 |
| 4 | 0.072 | 0.033 | 0.237 | 0.097 | 0.029 | 0.74 | 3.29 | 0.458 | 0.139 | 11.0 | 76 |
| 5 | 0.070 | 0.033 | 0.253 | 0.089 | 0.029 | 0.79 | 3.61 | 0.471 | 0.126 | 11.8 | 58 |

The results of the soil analyses show that in the case of the oranges there is a marked inverse correlation between the humus content of the soil and the percentage of mottling, the latter tends to diminish as the humus content increases. A statistical study of the data shows that 50 per cent of the cases of mottling can be accounted for by the low humus content of the soil. The humus content of the lemon soils studied averages less than 0.1 per cent, an amount which is too small to produce a normal growth, and which is nearly always associated with mottling.

No correlation was found between the proportion of mineral carbonates in the soil and mottling ; it was noticed that in lemons the mottling decreased slightly as the mineral carbonates increased, but the changes were so slight that it cannot really be considered as a case of correlation. In all the soils examined the lime content is low, and its application in large quantities benefits lemon trees more than orange trees, more especially when the soil is rich in humus.

There is no relation between the total nitrogen and mottle-leaf either in oranges or in lemons. The greater the proportion of organic carbonates with regard to the humus, the more the leaves of the tree are attacked ; and in the same way, the more proportion of humus is raised the more the disease is checked. This does not prove that humus is the organic substance best fitted to give rise to the development of healthy and normal leaves, but it shows that in a soil which is able to convert organic matter into humus, the organic matter, during the process of decomposition, passes through stages when it is very readily absorbed by the plant roots. Addition of organic substances which can readily be assimilated to the soil is therefore suggested as a new means of checking the attacks of mottle-leaf.

## DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

GENERALITIES

1226 - **Climatic Conditions as related to *Cercospora beticola*.** — Pool, V. W., and Mc Kay, M. B., in *Journal of Agricultural Research*, vol. VI, n. 1, pp. 21-60, fig. 1-10, Pl. III-IV. Washington, D. C., 1916.

Experimental work on the subject in hand leads to the following conclusion:

1) The life of the fungus *Cercospora beticola* wintering in sugar-beet top material varies according to the environment. When exposed to outdoor conditions the conidia die in one to four months; but when kept dry they live as long as eight months. The sclerotia like bodies, which are more or less embedded in the tissues of the host, are more resistant than the conidia, living through the winter when slightly protected, for example, in the interior of a pile of sugar-beet tops or buried in the ground at a depth of 1 to 5 inches, and become a source of infection for the succeeding crop. Notwithstanding the difference in temperature and soil moisture condi-

tions similar results were obtained from wintering experiments at Rocky Ford, Colorado and Madison, Wisconsin.

2) Climatic conditions and the development of the leaf spot can only be correlated when all records are taken at the same relative positions, as shown by comparison of the Weather Bureau records and the records taken among the plants and 5 feet above the field.

3) The maximum temperature early in the season is much higher near the ground than it is 5 feet above, but the difference diminishes as the season advances.

4) Throughout the season the maximum humidity was higher among the leaves than 5 feet above the field. Early in the season while the plants were small the humidity remained above 60 longer each day at 5 feet above the field than among the plants near the ground; but after the plants attained a good size this condition was reversed. Because of this difference only records collected among the leaves should be considered in correlating climatic conditions and conidial production and infection.

5) The effect of rainfall and irrigation on the increase of relative humidity and its duration is apparently much the same.

6) Thermal tests with artificial cultures showed that:

*a*) exposure to constant temperatures of 35° and 36° C. is fatal to to the growth of the fungus;

*b*) growth occurred when cultures after exposure for 3 days to either of these temperatures, were changed to 30.8°, and also when they were held at either for 8 hours and then at 20° for 16 hours;

*c*) a temperature of 40.5° was fatal in all combinations tested.

7) Temperature and relative humidity influence the production of conidia and infection in much the same way. A temperature of 80° to 90° F., with a night minimum preferably not below 60°, is most favourable to conidial production, while it is checked by a temperature of 100° or more, and is greatly checked by a range from below 50° to 80°. A maximum humidity ranging above 60 for not less than 15 to 18 hours each day induces a good growth of the fungus.

8) Because of the greater degree of moisture on the lower than on the upper side of the leaf the conidia are generally more abundant on the lower surface of the spots, but because of the action of rain and wind they disappear more rapidly from the upper surface.

RESISTANT PLANTS

1227 - **The Susceptibility of *Phaseolus vulgaris* to Haricot Rust (*Uromyces appendiculatus*)** (1). — JORDI, E., in *Zeitschrift für Pflanzenkrankheiten*, Vol. 26, Nos. 6-7, pp. 374-375. Stuttgart, Sept. 16, 1916.

In 1915 the writer cultivated 5 varieties of *Phaseolus vulgaris* (Ohne Gleichen, Blaue Speck, Sans Viacre, Phänomen, Klosterfrauen). The three first were grown in one field, and the other two together with the first one, in a second field.

The second field, 98 yards long by 27 yards wide, was divided into three

(1) See *B.* August 1916, n. 933. (*Ed.*).

equal parts, the first being planted with Phänomen, the second with Klosterfrauen and the third with Ohne Gleichen. By September 15, 1915 the writer had been able to prove that Phänomen was very severely attacked by rust, while Klosterfrauen on the next plot was attacked very slightly. The third plot planted with Ohne Gleichen behaved exactly like the first.

The first field planted with the three first mentioned varieties was attacked fairly severely all over.

1228 – **The Resistance of Lucerne to *Pseudopeziza Medicaginis* in Uruguay Attributed to the Use of Nitragin.** — See No. 1180 of this *Bulletin*.

DISEASES OF VARIOUS CROPS

1229 – **Diseases and Insect Pests which Attack Rice in Java.** — RUTGERS, A. A. L., in *Teysmannia*, Year 27, No. 6, pp. 313-342. Batavia, 1916.

Rice in Java is very considerably damaged by diseases and enemies of one sort or another. For the last four years the total loss of plantations wa s estmated at an average of 242 172 acres. In addition there is a considerable loss due to the decreased productivity when the rice is attacked by insects. In 1912 complete failure of the crop was caused in several parts of the island by insects. The monetary loss was estimated at about L. 200 000.

Although most of the diseases and pests have been fully investigated, the relations that exist between the methods of cultivation and the attacks of the pests still require further study so that means of suppressing the latter can be discovered.

Most of the mischief is done by insects; fungal diseases are not of of any great importance. Diseases due to climate or to soil conditions sometimes play quite a large part.

The following pests are mentioned: 1) « Omo Mentek », root rot caused by shortcomings of the soil; to combat this disease improvement of the soil by cultivation should be aimed at; above everything stagnant water should be avoided, as it encourages de-oxidation of the soil; 2) « Omo Djenoe », caused by *Tilletia horrida*, only once seen in Java without doing much harm; 3) « Djamoer Parah », caused by *Ustilaginoidea virens*; the cases observed are rare and the losses inconsiderable: 4) blotches on the leaves are caused by *Napicladium*, *Helminthosporium* and *Piricularia* spp.; it remains to be proved whether the attacks of these fungi can result in a total loss of the plant; 5) *Sclerotium Rolfsii* which sometimes leads to the loss of several leaves; 6) « Omo Wereng », caused by the *Cicadellidae* or by the *Delphacinae*, which can result in serious losses; the insects attack the flowering stems which in consequence produce no caryopsis; 7) « Omo Walang sangit », caused by *Leptocorisa acuta*; this insect attacks the young grains and sucks out their contents; the loss can be considerable; 8) « Omo Lembing », caused by *Antestis histrio* (*Pentatomidae*) or by *Nezara viridula*, *N. griseipennis* and *Podops vermiculatus;* these insects by attacking the stems prevent the ripening of the caryopsis; 9) « Omo Soendep », caused by *Schoenobius bipunctifer* or by *Scirpophaga sericea*, *Sesamia inferens* or *Chilo* sp., all these insects make their way into the flowering stems where the larvae bring about a total loss; «Omo Soendep » is one of the

worst enemies of rice cultivation in Java; 10) « Omo Poetih », caused by *Nymphula stagnalis* or *Cnaphalocrocis jolinalis*, these insects attack the leaves which they feed upon; to destroy them it is only necessary to flood the rice plantations; 11) several other insects such as *Cirphis unipunctata, Psalis securis, Melanitis leda* and some of the *Hesperidae*, which also feed upon the leaves and at times do a good deal of damage; 12) *Tinea* sp. which can lead to serious losses in stored rice; 13) *Cecidomyia* sp. and another Dipteran hitherto unidentified which sometimes attack the nurseries; 14) *Calandra oryzae*, which attacks shelled rice; 15) among the mammals are rats which can do a great deal of harm in the plantations, and birds also, especially *Munia oryzivora* which is a perpetual source of danger, necessitating a continuous watch being kept in the plantations when they are dry, so that the intruders may be driven off.

1230 - **On the Reappearance of Mildew (*Phytophthora infestans*) in the Haulm of the Potato.** — Eriksson, J., in *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 163, No. 4, pp. 97-100. Paris, 1916.

The writer has drawn the following conclusions from his further investigations of *Phytophthora infestans*:

1) In the field the disease does not appear until 3 or 4 months after the tubers are planted. In Sweden the first attack varies from the middle of July to the end of September according to the weather.

2) In the first outbreak of the disease which comes at the end of the summer the leaves are seen to have large, distinct, black patches especially the more vigorous ones which spring from the base of the plant, at the same time the lower surfaces are covered with a fine greyish dust. At the end of 2 or 3 days the black patches begin to invade the tubers. Damp and misty weather encourages the growth of the fungus.

3) Where the tubers are planted in frames in January the first traces of the disease appear in the middle of April when the stems and leaves are fully developed. The tubers are at this time as well developed as are those of field grown potatoes at the end of the summer.

4) After the early appearance of the fungus in the tubers in hotbeds the stems and the petioles are invaded and take on a greyish colour. The petioles often become thread-like but the blades remain green without showing any sign of the disease.

5) On the first day several zones can be distinguished in the diseased patches. Starting from the middle and radiating outwards there are: *a*) a dark brown region verging upon black; *b*) a velvety grey region; *c*) a pale yellow region free from rust; *d*) a region of healthy dark green which lies about 10 mm. away from *b*.

6) In the dark green region and in the adjoining pale green part the cells are normal, with nuclei, chlorophyll grains etc. Only the cytoplasm of the cell differs from normal cytoplasm.

With the help of powerful magnification the presence of black spots in the plasma between the chlorophyll grains has been shown. No other trace of the mycelium has been discovered either in the cells or in the adjoining spaces.

7) In the primary phases the structure of the cytoplasm of the cell undergoes changes. The grains of chlorophyll are on the verge of disintegration (chlorophyll disintegration phase) and at the same time the plasma itself is granular.

8) In the following phase the structure of the cytoplasm alters: the chlorophyll grains are broken down, the whole mass of plasma seems to be more granular and contains numbers of nucleoli (4 to 6) (nucleolar phase). As a result of the disintegration of the chlorophyll the leaves turn black.

9) This phase is followed by another in which greater changes come about. The plasmic granules gather together in certain parts of the cell, especially in the palisade tissue of the parenchyma. The plasmic mass often lies within them. Sometimes the collection of granules is found in the middle or it may lie towards the wall nearest to the epidermis. The nucleoli are replaced by cytoplasmic granules of irregular shapes (maturation phase).

10) The plasma within the diseased cell from the very beginning is of two kinds: there is the plasma of the host and that of the fungus. They are intimately mingled and form a symbiotic association which, inherited from the parent plant, spreads from cell to cell. The writer speaks of this plasmatic association as « mycoplasma ». At a certain stage in the development of the nurse-plant a struggle begins between the two, which ends in a victory for the fungus.

11) At this time the plasmic body leaves the cell and penetrates into the intercellular spaces where it begins to form the mycelium. The plasma bores through the cell wall where the granules are specially thick (mycelial stage).

The plasmic mass becomes filamentous, the filaments being either simple or branched, according to the size and shape of the intercellular space. If the plasmic mass makes its escape at the outer end of a palisade cell it becomes a fine thread which gets in between the epidermis and the cells below. At the inner end one often sees a large vesicle entirely or partly empty, its contents having been discharged into the filament.

12) The development of the mycelium seems to proceed in two directions; some remain thin and show separate nucleoli. Some of these break off from the filament as separate structures and develop into oögonia. The writer distinguishes these filaments as female. Other of the filaments increase in size and their contents are evenly distributed throughout their length. These strands branch irregularly and often give rise to forks which may develop into antheridia. These are described as male filaments.

13) Fertilisation occurs between the ripe antheridia and oögonia giving rise to an oospore. The oospores appear either singly or joined in twos and threes in the disorganised cellular tissue of the diseased patch. They are spherical, 20 μ to 38 μ in diameter, with thick, smooth walls.

14) The oospores can germinate as soon as they are formed. They are in no sense resting spores to insure the survival of the fungus after the winter, but true summer spores whose life has a very definite duration.

15) Having reached the inner opening of a stomate the oospores develop giving rise to two or three fine branches which emerge by the stomate. As soon as these filaments are formed they can produce a terminal spore, ovoid or lemon-shaped, which can also develop into a longer filament with branches. Then the conidia are borne on the ends of the branches (terminal spores) or in little swellings of the filament (lateral spores).

16) The first conidia germinate as do the sporangia. Their contents are differentiated into 8 distinct zoospores which are freed through an opening in the apex of the sporangium; they can begin their development as soon as they are formed. The whole evolution, from the disintegration of the chlorophyll grains of the cell host to the time when the zoospores are liberated, is probably accomplished in one day. The fungus is propagated after this stage by the zoospores.

1231 – **The Disease of Potatoes known as "Leak", caused by *Rhizopus nigricans* and *Pythium de Baryanum*.** — HAWKINS, L. A., in *Journal of Agricultural Research*, Vol. VI, No 17, pp. 627-640, Fg. 1, Pl. XC. Washington, D. C., 1916.

The tuber-rot of potatoes known as potato « leak » is a disease of considerable importance in the delta region of San Joaquin River in California, where potatoes are cultivated on a very large scale. As a rule the disease appears soon after harvesting, in the hot weather, in warehouses and during transport and it often ruins whole shipments. No exact data could be collected as to the losses but in 1915 for an area of 400 000 acres the loss probably lay between £. 10 410 and £. 31 250.

The first sign of the disease is the appearance of a small brown discoloration around a wound of some kind, such as is easily made with a hoe. In more advanced stages the entire surface of the potato is discoloured, the tissues soften and shrivel; if tubers in this condition are crushed a brownish watery liquid oozes out.

Although *Rhizopus nigricans* Ehren. can produce a tuber-rot similar to that occuring in leak, this fungus has not been isolated in field experiments from tubers affected with leak. In numerous cases *Pythium de Baryanum* Hesse has been isolated and must be regarded as the most common specific cause of the disease; inoculation experiments have given positive results. The mycelium is irregularly branched, with conidia borne either terminally or intercalarly, they are spherical with an average diameter of 22 μ. They germinate as soon as they are placed in water at the ordinary room temperature. The oogonia are spherical and vary from 15 to 25 μ in diameter. The antheridia either occur on the same filament with the oögonia or on an adjacent filament. The oospores are smooth, spherical and thick-walled, with an average diameter of 16 μ.

*Pythium de Baryanum* is common throughout the delta region of the San Joaquin River, and if infected soil is placedincont act with wounded tubers they are readily infected with the disease. As a great many of the injuries are probably inflicted with the hoe when the potatoes are dug, great care in digging is recommended, and a careful sorting out of all the wounded tubers.

1232 – ***Fusarium oxysporum* and *F. tricothecioides* in their Relation to Tuber-rot in Potatoes.** — LINK, G. K. K., in *The Botanical Gazette*, Vol. LXII, No 1, pp. 169-209,, Fg. 1-13. Chicago, Ill., September 1916.

*Fusarium oxysporum* Wilcox and Link is identical with *F. trichothecioides* Woll.

Tuber-rot and decay of the whole plant are produced by F. *oxysporum* in the same way as by *F. trichothecioides*. The withering of the haulm is due to the destruction of the roots and the blocking of the xylem elements in the stem; in mild cases the disease is characterised by such symptoms as discolouration and drooping of the leaves and by the appearance of aerial tubers.

In the conditions that one meets with in the field and in stores *F. oxysporum* seems to be more definitely the cause of decay than is *F. trichothecioides*, while the latter appears to be responsible for rot in the tubers. The optimum and maximum temperatures for *F. oxysporum* are higher than those for *F. trichothecioides* which develops well from 8° to 10° C. These facts can in part explain the different effects of the two fungi. *F. oxysporum* increases and spreads more rapidly than *F. trichothecioides*, a circumstance which can be correlated with the greater need for oxygen shown by *F. oxysporum*, and which explains why the fungus invades the xylem elements.

The two species both possess marked powers of utilising organic matter of all kinds in their metabolism. *F. oxysporum* has this faculty in the greater degree and can make use of more varied substances than can *F. trichothecioides*, but the destruction of the organic matter is not so complete.

The growth in *F. oxysporum* is less readily arrested than is the case in *F. trichothecioides*. Solanine is not toxic to either species, although in the case of *F. trichothecioides* it seems to check the growth.

1233 – ***Urophlyctis Alfalfae* on Lucerne (" tumeurs marbrées ") in France.** — ARNAUD, G., in *Journal d'Agriculture pratique*, Year 80, N. S., Vol. 29, N. 17, pp. 291-292, fig. 58. Paris, August 1916.

The Station of Plant Pathology in Paris received specimens of lucerne from Villepreux (Seine-et-Oise) which were attacked by *Urophlyctis Alfalfae* at the base of the stems.

The soil of the fields from which the specimens were taken was dry and permeable and owing to the lack of water was not really suitable for lucerne. The disease had developed irregularly. To check the disease it is best to plough up the lucerne in infected fields and replace it by some other crop.

1234 – ***Stilbella Heveae* and *Ustulina zonata*, Pests on Rubber in Sumatra.** — VRIENS, J. G. C., in *Mededeelingen van den Adviseur der A. V. R. O. S.*, No. 5, pp. 66-68. Médan, 1916.

The mycelium of *Stilbella Heveae* spreads out into fine white threads over the young shoots and leaves of the rubber tree. Soon the leaves which have been attacked lose their colour and die, and are left hanging on to the branches by threads of the mycelium.

The writer has been able to show that the disease can be stamped out

by gathering together and burning the infected stalks and leaves. The damage caused by the disease is comparatively insignificant.

In the same paper there are reports of two cases of *Ustulina zonata* on rubber at Deli (Sumatra).

In the Federated Malay States this fungus does a great deal of harm in rubber plantations as SHARPLES has recently stated (1). It attacks the wood, having effected its entrance by means of the holes made by mining insects or by other wounds. This disease is probably very contagious.

As a means of prevention the writer advocates the removal of all dead wood that could shelter insect pests from the plantation.

1235 - ***Botrytis* (*cinerea*?) and *Rhizopus* (*nigricans*?) as the cause of Rot in Strawberries in the United States.** — STEVENS, N. E., in *Journal of Agricultural Research*, Vol. VI, No. 10, pp. 361-366, Pl. XLIX-L. Washington, D. C., 1916.

Strawberries sent out from the Southern States are very often spoilt by *Botrytis* (*cinerea*?) and *Rhizopus* (*nigricans*?), which cause rot during shipment and on the market. The pathological processes are very different in the two cases.

*Botrytis* sp. — The mycelium penetrates into all parts of the berry it fills up the intercellular spaces with a network of hyphae which surrounds the cells and tissues so that the berry keeps its shape and only undergoes a slight shrinkage without much loss of juice.

The hyphae readily dissolve the middle lamella and are able to penetrate into the cells where they very quickly bring about the disintegration of the proptoplasmic contents so that the nucleus can no longer be distinguished.

*Rhizopus* sp. — The berries become flattenend and there is a considerable loss of juice. The mycelium of the parasite normally develops quite near the surface of the berry in the outer 6 or 8 cell layers, and only very rarely does it make its way into the cells.

The nuclei of the cells persist in apparently normal condition until the cytoplasm has almost entirely collapsed. Under very dry conditions (a dessicator with concentrated sulphuric acid) *Rhizopus* sp. develops to such an extent that it extends to the middle of the berry; in this case the hyphae are often found inside the cells.

It is rare to find both parasites in the same berry. But often *Botrytis* sp. is found with *Fusarium* sp. or with *Alternaria* sp., or *Rhizopus* sp. is found with *Fusarium* sp. In these cases the two mycelia mingle in the tissues of the berry, but they may also occupy two distinct zones with a marked line of division as is the case with *Botrytis* sp. and *Alternaria* sp.

It is possible that *Rhizopus* sp. can occur in a region originally infected by *Botrytis* sp. or by some other fungus. The writer's researches however point to the conclusion that *Rhizopus* sp. is not dependent upon the presence of any other fungus in its attacks on strawberries during shipment or on the market.

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(1) See *B.* July, 1916, N° 812. (*Ed.*)

## WEEDS AND PARASITIC FLOWERING PLANTS.

1236 - **Researches on the Dodder of Flax (*Cuscuta Epilinum*) in Germany.** — OBERSTEIN, in *Illustrierte landwirtschaftliche Zeitung*, Year 36, No. 78, pp. 525-526. Berlin, Sept. 27, 1916.

Hitherto dodder has only appeared to a slight extent upon flax in Germany. In the literature of the subject there are records of its appearance in large quantities in Saxe-Altenbourg (1904), in Bavaria (1905-06) in the Grand-Duchy of Reuss, in West Prussia and in Posnania (1908). During the last year it has also been reported from Silesia having probably been imported with flax from Russia (1).

The writer profited by this opportunity to investigate the germination of the seeds and the question of their different plant hosts. The work was carried out in the Seed Testing Station of the Silesian Chamber of Agriculture. On 13 April 1916, 100 seeds of dodder were sown and allowed to germinate in 4 sets of sterile sand. After 3 days 29, 30, 19 and 39 per cent of the seeds had begun to germinate; 3 days later the percentages were increased by 15, 15, 19 and 5 respectively; 10 days after sowing the percentages of seeds which had germinated were 45, 48, 51 and 44. A germination experiment carried out at the same time with *C. Trifolii* and *C. racemosa*, but using the method employed for clover, gave the following results: with *C. Trifolii* the maximum number of seeds which had germinated after 24 hours was 2 per cent; while with *C. racemosa* the percentages were 4, 8, 4 and 9 after 5 days and 18, 25 16 and 26 respectively after 24 days.

All these experiments therefore confirm the opinion which is generally held, namely, that the dodder of flax, owing to its relatively high germination, is well adapted to the short duration of its principal plant host.

Pot experiments with dodder seeds gave flourishing plants from June and July onwards; they developed equally well on red clover and on flax, although the former appears to suit them less well. The red clover however suffered less than did the flax which was often completely choked during the course of its growth. Good flowers were only obtained when the flax was slightly attacked by dodder. The dodder flowers equally well on red clover and on flax if the pots are watered from time to time.

Dodder which was grown on red clover produced ripe seeds just as it does on flax. Ripe seeds were also obtained from dodder on *Lathyrus Aphaca* and on *Vicia hirsuta*, which had accidentally found their way into the pots with the flax.

The results embodied in this paper are not in entire agreement with those obtained by previous workers so that further work upon the subject is still required.

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(1) See *B.* January, 1913, N° 75. (*Ed.*).

1237 - **Seeds of Weeds and of Cryptogamic Diseases observed in Sowing Cereals from the Maritime Province of Eastern Siberia.** — See N° 1174 of this *Bulletin*.

1238 - **An Attempt to Destroy Wild Mustard (*Brassica Sinapistrum*), in Fields of Cereals.** — DUSSERRE, C., in *Travaux de Chimie alimentaire et d'Hygiene*, Vol. VII, Part 6, pp. 357-358. Berne, 1916.

In order to replace the sulphates of iron and copper, and powdered kaïnite, which have been used hitherto to destroy wild mustard and are now expensive and difficult to procure, the writer made experiments in spraying with a 20 to 30 per cent solution of potassium chloride, which can be procured in sufficient quantities at its original price. Trial was made on April 28, 1916 on an oat field at Ecublens (Vaud), which was overgrown with wild mustard, the plants having 2 or 3 leaves unfolded. The result was very satisfactory: the plants touched by the liquid were completely shrivelled up; the few which had received less of the solution withered and appeared to be very sickly. The field in this way was cleared of this weed and the oats developed vigorously. Plants of *Ranunculus sceleratus* which were common in the field were also destroyed.

The writer suggests that more concentrated solutions should be employed (55 lbs. of a 30 per cent salt in 22 gallons of water) and that it should be sprinkled on to the plants by means of a vine sprayer on a fine morning after heavy dew. For a field that is badly infested one must reckon about 352 lbs. of salt dissolved in 1092 gallons per acre; the solution is prepared simply by placing the proper amount of the solid in a bag and suspending it in the measured amount of water. This treatment has no bad effect upon the cereal and represents, in fact, a very fair amount of potash manure, which can only have beneficial effects upon the harvest.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

### GENERALITIES

1239 - **Animal Pests on Cultivated Plants Observed by the Entomological Bureau of Stavropol in 1914.** — UVAROV, B., in *Rapport sur les travaux du Bureau entomologique de Stavropol au Caucase pour l'année* 1914, pp. 102-105. Petrograd, 1916.

The most important among the insects which are pests upon cultivated plants in Stavropol is the migratory locust (*Pachytylus migratorius* L.) which was observed in 1914 in only one single locality on the River Kouma. This insect has been completely destroyed by repeated sprayings begun in 1908 under instructions issued by the Bureau, 1914 being the last year in which the treatment was used. In addition to this method of dealing with *Pachytylus* experiments have been made using baits of bran and treacle poisoned with potassium arsenite. These experiments have given splendid results. Besides this two sprayers have been tested: a horse drawn machine and a knapsack sprayer. The latter has been found to be the more convenient for the migratory cricket.

Observations upon harmful insects have been made by the staff of the Bureau during their tours, and at two places in the district temporary laboratories have been equipped to the same end; thus a great number of

pests have been observed which have escaped notice in previous years, and more detailed investigations of the ones already known have been made.

Among Arachnoidea, *Bryobia ribis* Thomas, which attacks gooseberry bushes in the spring, has been seen for the first time.

*Thrips linarius* Uzel has damaged flax to a considerable extent.

The following Hemiptera have been recorded for the first time on fruit trees and shrubs in orchards: *Mezocerus marginatus* L., *Rhyparochromus chiragra* F., *Calyptonotus rolandri* L., *Drymus sylvaticus* F., *Piesma maculata* L., *Monanthia echii* Schrc. and *Lygus rubicundus* Fall., on flax, *Carpocoris lunulatus* Goeze and on lucerne, *Brachycoleus scriptus* Fl., *Adelphocoris vandalicus* Rossi and *A. ticinensis* Mey. The *Cicads* collected have not yet been identified by the Bureau; a great many specimens of *Deltocephalus* sp. and *Cicadula* sp. have been found on cereals. A certain number of plant lice have been recorded, and some species have been noted: *Chaitophorus populi* L. (on white poplars); *Sitobion cereale* Kaltb., *Aphis obnoxia* Mordwilko n. sp., *Aphis* sp. (all the three preceding forms from cereal crops); *Rhopalosiphum ribis* Buct., (on gooseberries); *Aphis prunina* Walk. (on plums); *A. vitis* Scop. (on vines); *A. craccivora* Koch (on lentils); *A. persicae* B. de F. (on peaches and almonds) ; *A. crataegi* Kaltb. (on the apple). Of the *Coccidae, Phenacoccus aceris* Sign. (*Dactylopius vitis* Licht.) has been found in cracks in the bark of apple trees.

Among the Lepidoptera, *Lymantria dispar* L. has been increasing with great rapidity in the valley of the Kouma and has caused a great deal of damage. Two caterpillars (*Heliothis dipsacea* L. and *Phalonia epilinana* Zell.) have attacked flax ; the first was studied by SHAMRAY and the existence of two summer generations has been established. The following species have been observed this year for the first time : *Pieris daplidice* L., whose caterpillars cause havoc among the plants of white mustard ; *Deilephila lineata* F. var. *livornica* Esp., on the vine ; *Poecilocampa populi* L., on *Populus pyramidalis* ; *Gastropacha quercifolia* L., on the plum ; *Acronycta tridens* Schiff., on the apricot ; *Cucullia santonici* Hb. on sunflowers ; *Eubolia arenacearia* Hb., in great numbers on lucerne. The *Microlepidoptera* pests have been the objects of very detailed work, and a certain number of species have been recorded which had not been described. Such are : *Sarrothripus revayana* Sc., on the poplar ; *Cledeobia moldavia* Esp. (the caterpillars were abundant in the steppes) ; *Pionea forficalis* L. on cruciferous plants ; *Tortrix viridana* L., whose caterpillars have done a great deal of harm to the oaks in Stavropol and its surroundings ; and several species which principally attack fruit trees, such as : *Acalla holmiana* L., *Cacoecia podana* Sc., *C. rosana* L., *Pandemis ribeana* Hb., *P. heparana* Schiff., *Steganoptycha* sp., *Gelechia rhombella* Schiff., *Coleophora nigricella* Stgch.

The staff of the Bureau have devoted especial care to the life histories of the *Curculionidae* that attack fruit trees. The most important of these are : *Otiorrhynchus aurosparsus* Germ., *Phyllobius oblongus* L., *Sciaphobus squalidus* Gyll. and *Anthonomus pomorum*. The principal plant host of

the first of these which destroys the shoots, flowers and leaves of fruit trees, is the stinging nettle according to GLAUSOUNOFF, so that well kept gardens are free from it ; the reproduction in this, as in the allied species of *Otiorrhyncus*, is parthenogenetic. A more detailed account of two Coleoptera has been given, both of them being pests on mustard : *Colaphus höfti* Men. and *Lixus ascanii*. ; the former has only one generation of larvae in the summer and hibernates in the adult state ; the latter, it appears, has two larval generations and it is the larvae which hibernate. The following Coleoptera are now reported as being harmful : *Podonta* sp., on the flowering ears of corn ; *Lina populi* L., on poplars all along the River Kouma ; *Otiorrhyncus ligustici* L., which is a serious pest on lucerne ; *Phyllobius pyri* L., on *Ulmus ; Eudipnus micans* F., also on *Ulmus : Psalidium maxillosum* F., on mustard ; *Cleonus puncliventris* Germ. and *C. nigrivittis* Pall. var. *kindermanni* Est., on mangolds ; *Ceutorrhyncus macula-alba* Hrbst., which causes great damage to poppies ; *Baridium scolopaceum* Germ., on mangolds : *Rhynchites giganteus* Kryn. with other allied species on fruit trees ; *Blithopertha lineata* Fbr., which injures the leaves of haricot beans and is also found, with species of the genus *Anisoplia*, on the ears of wheat.

Among the Diptera large number of *Contarinia tritici* Kirby have been seen, which have not done much harm.

Important among the observations on the Hymenoptera are the records of damage done to maize shoots by ants, and GLAUSOUNOFF's researches on the Tenthredinidae of cereals (*Cephus pygmaeus* L. and *Trachelus tabidus* L.). These two species are evenly distributed throughout the region and it is of practical as well as theoretical interest to discover what are the diagnostic features of their larvae. A study of the external characters is useless in this connection, but there are great differences in the form of the silk-producing glands ; a detailed description of the morphology and anatomy of these larvae will be published in a separate paper. The following Hymenoptera pests are recorded for the first time in this region : *Xylocopa violacea* F., which has done a good deal of harm to the wooden constructions in the villages ; *Eurytoma amygdali* End., in the kernels of plums ; *Hoploxampa fulvicornis* Klg., in plums ; *Athalia spinarum* F., on cabbages and mustard.

Besides the harm done by insects, very serious damage has been caused by field mice (probably *Microtus* sp.) which occur in great numbers in the south of the Government, and in certain places have destroyed the seedlings of cereals. The number of ground-squirrels (*Spermophilus* sp.) increases each year and the methods used for their destruction are inadequate owing to the lack of the necessary resources.

1240 – **Insect Pests of Agriculture in British East Africa.** — DEAKIN, R. H., in *The Annals of Applied Biology*, Vol. II, N° 4, pp. 241-244. Cambridge, 1916.

During the year 1914 large bands of *Schistocerca peregrina* some in the adult and some in the larval condition appeared throughout the Protectorate ; the damage done was not extensive, only a few plants of coffee and of maize being attacked.

Among the pests that attack coffee *Antestia variegata* is the most serious ; however, according to the writer, the development of this insect is checked by the presence of a Chalcid, hitherto unidentified, which is parasitic on its eggs. The Chalcid lays an egg in each of the eggs of the *Antestia*, and the number of infected eggs often exceed 50 per cent. The writer suggests that the development of this Chalcid should be encouraged and that it should be introduced into regions where at present it is unknown.

Coffee is also attacked by *Lecanium nigrum*. A great many individuals of this species fall a prey to parasites. Other pests are *L. africanum* and *Euxoa segetum*. To keep the latter in check the soil must be kept free from weeds and intelligent use should be made of poisoned baits.

The following have been recorded from Citrus plants : *Argyroleucotreta*, whose larvae attack ripe oranges ; *Icerya purchasi*, which does not appear likely to be serious in the Protectorate ; little Coleoptera (*Halticinae* ?) appeared suddenly in numerous swarms in a Citrus plantation ; the young leaves of the plants were seriously injured ; *Papilio mackinonni*, whose caterpillars destroy the leaves of oranges ; a little mite which is not yet identified, has been recorded as a pest on oranges.

*Eriosoma lanigera* has been observed on apples ; winged individuals have not yet been seen.

The leaves of quince-trees have been seriously damaged by the larvae of *Orgyia vetusta*, of which an ichneumon fly is a useful natural enemy.

The larvae of *Duomitus capensis* bore through the branches of the indigo plant (*Cassia didymobotrya*) and kill them.

The writer has discovered a new enemy of Black wattle (*Acacia decurrens*) ; this is believed to be the larva of a Buprestid, but an adult individual has not yet been found. The larvae, which emerge from eggs laid on the trunk and branches, bore into the cambium and, if they are numerous, kill the tree. The best means of combating this pest is to fell the trees that are attacked and strip off the bark, and moreover to remove all the trees which seem to be in poor condition.

Two Hemiptera belonging to the families *Jassidae* and *Capsidae*, also cause very serious injuries to the same *Acacia*.

1241 – **Species of *Aleyrodidae* which are Harmful to Citrus and other Plants in Various Countries.** — QUAINTANCE, A. L,. in *Journal of Agricultural Research*, No. 12, pp. 459-472, fig. 1-3, Pl. LXIV-LXIX. Washington, D. C., 1916.

1) *Aleurocanthus citricolus* (Newstead), discovered on *Citrus* sp. at Dares-Salaam (German East Africa) ; 2) *A. citriperdus* n. sp., a pest on *Citrus* spp. in Ceylon, in India (Lahore), in Java (Buitenzorg and Sandan Glaya) ; *A. woglumi* Ashby (spiny citrus white fly) observed in India, the Phillipine Islands, Ceylon, Jamaica, Cuba, and the Bahama Islands ; plant hosts so far established : *Citrus* sp. (Lahore, Guiranwala, Kalimpong, Sikkim (India), and Kingston (Jamaica), orange (India, Manilla, Jamaica, Cuba and the Bahama Isles) ; *Capparis Roxburghi* and *C. pedunculosus* (in the Botanical Garden of Ceylon) ; *Morus* sp. (Lahore) ; *Salacia reticulata* and *Kurrimaia zeylanica* at Peradenyia (Ceylon) ; *Guaiacum officinale* and *Cestrum nocturnum* L. (at Kingston) ; undetermined plant hosts (India) ;

4) *A. spiniferus* (Quaintance), on *Citrus* sp. and on roses at Garalt (Java) and on oranges at Macao (Southern China) ; 5) *Aleurolobus marlatti* (Quaintance), on *Citrus* sp. and *Morus* sp. at Lahore ; on *Ficus* sp. in the Ceylon Botanical Garden ; on oranges at Tokyo and at Kumamoto (Japan), etc. ; on an unknown plant in the Buitenzorg Botanical Garden (Java) ; 6) *Aleurothrixus floccosus* (Maskell) common in the following localities : West Indies, Florida, Mexico, British Guiana, Brasil, the Argentine, Chili and Paraguay ; not only seen on the orange (Mexico) and on *Citrus decumana* and *C. Limetta*, but also on the sea grape (*Coccoloba uvifera*), *Plumeria* sp., *Baccharis genistelloides*, *Psidium Guajava*, etc. ; 7) *A. howardi* (Quaintance) on the same hosts and in the same localities as *A. floccosus* ; 8) *A. porteri* n. sp., on the orange at Santiago, Ransagua, San Bernardo (?) (Chili) ; on *Schinus dependens* at Santiago ; on *S. molle* in Chili ; on *Lippia citriodora* and *Myrtus* at Santiago ; on an unknown *Solanum* at Villa del Mar (Chili) and on *Eugenia cauliflora* at Rio de Janeiro (Brasil) ; 9) *Bemisia giffardi* (Kotinsky) on *Citrus* spp. in several gardens in Honolulu (Hawai) where it has probably been introduced, most likely from India, where it has been observed on an unknown host plant at Lahore ; 10) *Dialeurodes citri* (Ashmead), the so-called Citrus white fly, one of the most harmful pests upon citrus plants in Florida (where it has been known since 1880), and in all the States along the Gulf of Mexico ; recorded also from Colorado, Illinois, the Columbia District and California, and also from Mexico, Chili and Brasil ; without doubt this form is of eastern origin, being found in numerous localities in India, Ceylon, Japan and China ; in Florida it occurs not only on *Citrus*, but also on *Melia Azedarach*, *Gardenia jasminoides*, *Ligustrum* spp., *Diospyros Kaki*, *D. virginiana*, *Syringa* sp., *Coffea arabica*, *Ficus nitida*, etc. ; 11) *D. citrifolii* (Morgan), known in North Carolina, Mississippi, Louisiana, California, Florida, Cuba and Mexico ; besides being found on *Citrus* spp. it has also once been recorded upon *Ficus nitida* at Audubon Park, New Orleans ; 12) *Paraleyrodes perseae* (Quaintance), known only in Florida on oranges, *Persea americana* (avocado), *Persea* spp. and perhaps also on persimmons (*Diospyros* spp.) ; 13) *Trialeurodes floridensis* (Quaintance) in Florida on *Anona squamosa*, *Persea americana*, *Psidium Guajava* and on the orange ; but probably its attacks on the latter are of little importance ; 14) *T. vitrinellus* (Cockerell) on the orange in Mexico, and on oaks in California ; here again the orange is probably not seriously damaged ; 15) *Tetraleurodes mori* (Quaintance), a species which is indigenous to the eastern United States and is widely spread throughout them, attacking a great many plant hosts : (Mulberry-tree, *Platanus occidentalis*, *Acer*, *Cornus*, *Celtis occidentalis*, *Diospyros* spp., *Ilex*, *Kalmia*, etc.) ; recorded from Arizona and Mexico on oranges, where this parasite is a race rather than a variety of *T. mori*, to which the name of *arizonensis* (Cockerell) has been given.

1242 - ***Diestrammena marmorata* (*Tachycines asynamorus*), an Orthopteran from German Greenhouses.** — EBNER, R., in *Centralblatt für Bakteriologie, Parasitenkunde und Infectionskrankheiten*, Vol. 45, No. 18-25, pp. 587-594. Jena, June 19, 1916.

For several years a strange Orthopteran has occurred in greenhouses in Germany, which is known either as *Diestrammena marmorata* de Haan or as *D. unicolor* Brunner. In 1913 BOLDYREV established the fact that *Diestrammena* from Central Germany is identical with *Tachycines asynamorus* Adel. which is found in greenhouses in Petrograd. The writer has obtained several specimens from a greenhouse in Vienna which were identified as *T. asynamorus*. It is not known to what country this insect is indigenous, but most probably it was imported into Europe from America.

It was recorded for the first time in 1891 by KREJCI at Prague, and it has been known in hothouses in Hamburg since 1892. Later it has appeared in Saxony and in Thuringia, and notably in Kiel, Lubeck, Waudsbek, Münster, Berlin, Breslau, Frankfort o. M., Leipzig, Dresden, etc. It has also been found at Brussels (ADELUNG), Lille (1913), Paris (CHOPARD, 1913), in England (Kew Gardens, St. Leonard's and Ipswich, 1910-1913) and in Denmark (Frederiksberg). In almost all these places it has been described under the name of *Diestrammena*, but undoubtedly it is identical with *Tachycines*. In Austria it has only been reported from Prague and Vienna.

The insect only comes out at night when it is very active, being able to jump to a height of 19 $^1/_2$ inches. During the day it hides itself in pots or in cracks in the walls of the greenhouse. While the larvae are moulting they hang freely in the air suspended by the posterior end of the body.

When the insects are captured a brown liquid is excreted from the mouth. In summer they often leave the greenhouse during the night but never for long. The same thing has been observed in *Troglophilus* (an insect which lives in dark places) and the writer concludes that the two insects belong to the same group. But as *Tachycines* only inhabits greenhouses and never cellars, CHOPARD considers that a uniform temperature and a high degree of moisture are more essential than darkness.

Reproduction goes on all the year round, but more especially in the spring. According to BOLDYREV and GERHARDT copulation takes place at night. The female lays 1 to 50 eggs a night and altogether several hundreds are laid. The eggs are oblong and about 2 mm. long by 1 mm. wide. The behaviour of the young larvae is exactly like that of the adult insects.

The food principally consists of animal matter, but according to LUDWIG and EBNER it is probable that vegetable material also can be utilised.

The writer believes that this insect does more harm than is generally supposed, but unfortunately no satisfactory methods of dealing with it are known. Great cleanliness in the greenhouses is recommended and also fumigation with sulphur vapours and with carbon bisulphide.

Several investigators recommend spraying the plants with Schwein-

furth's green, but the writer considers it scarcely probable that this method will destroy the eggs in the ground.

In conclusion it is suggested that a further study of the origin and life-history of *Tachycines* should be made, and that further esperiments on preventive methods should be undertaken.

MEANS OF PREVENTION AND CONTROL

1243 – **New Species of Braconid Hymenoptera, Parasites of Tripanids Diptera in India.** — SILVESTRI, F., in *Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore d'Agricoltura in Portici*, Vol. XI, pp. 160-169, Fig. I-VI. Portici, September 27, 1916.

A description is given of the following new species of Braconid Hymenoptera which are parasitic on Tripanids collected from various localities in India by THOMAS BAINBRIGGE FLETCHER :

1) *Bracon fletcheri* n. sp., obtained from fruits of *Zizyphus Jujuba* Lam., which were attacked by *Carpomyia vesuviana* A. Costa ;

2) *Opius fletcheri* n. sp., obtained from the pupae of *Chaetodacus cucurbitae* Coquillet, whose larvae live in the fruits of *Momordica Charantia* L.

3) *O. incisi* n. sp., at Pollibetta, Southern Coorg, obtained from the pupae of *Chaetodacus incisus* Walk., living in fruits of *Careya arborea* Roxb. (jak fruit) ;

4) *Biosteres carpomyiae* n. sp., at Pusa, obtained from pupae of *Carpomyia vesuviana* A. Costa ;

5) *B. persulcatus* n. sp., in northern and southern Coorg, obtained from pupae of *Chaetodacus incisus* Walk. ;

6) *B. compensans* n. sp., in Coorg, obtained from pupae of *Chaetodacus incisus* Walk., living in the fruits of *Careya arborea* Roxb.

1244 – **The Green Lacewing Fly (*Chrysopa californica*), a Natural Enemy of Insect Pests in the United States and in California.** — WILDERMUTH, V. L., in *Journal of Agricultural Research*, Vol. VI, No. 14, pp. 515-525, Fig. 1-7. Washington, D. C., 1916.

The larvae of *Chrysopa californica* Coquillet destroy large numbers of insects which are parasitic on cultivated plants notably : clover mite (*Bryobia pratensis* Garman), two spotted mites (*Tetranychus mytilaspidis* Riley), red spider (*T. telarius* L.), apple leafhopper (*Empoasca mali* Le Baron), grape leafhopper (*Typhlocyba comes* Say), Pear Psylla (*Psylla pyricola* Foerster), mealy plum plant louse (*Hyalopterus arundinis* Fabricius), melon aphis (*Aphis gossypii* Glover), black peach aphis (*A. persicae-niger* Erwin Smith), green Citrus plant louse (*Macrosiphum citrifolii* Ashmead), Citrus mealy bug (*Pseudococcus citri* Risso), frosted scale (*Eulecanium pruinosum* Coquillet), red scale (*Chrysomphalus aurantii* Maskell), purple scale (*Lepidosaphes beckii* Newman), wheat thrips (*Euthrips tritici* Fitch), barley mite (*Notophallus viridis* Banks), green bug (*Toxoptera graminum* Rondani), and corn leaf aphis (*Aphis maidis* Fitch).

Every female lays about 30 eggs, each one being supported by a slender stalk ; the eggs are hatched at the end of 6 to 12 days. The larvae pass through two moults which divide the larval period up into three stages, occupying 11 to 22 days, the average time being 16 days.

The larvae are very voracious, each one being able to dispose of 74 to

160 aphids. The time occupied by the pupal stage varies according to the season ; in March it lasts from 14 to 23 days, the average time being 16 days, and in November the limits are the same but the average is 20.

This species of *Chrysopa* has six generations annually ; the first from February 15 to March 15, and the others following on at intervals of 40 to 45 days until late into the autumn.

This insect is common and widely distributed in the States bordering on the Pacific, Texas, Arizona, New-Mexico, Nevada, southern California, and possibly in Utah. Among its natural enemies the chief are the western wood peewee (*Contopus richardsonii*) and the nighthawk (*Chordeiles virginianus*).

1245 - ***Signiphora merceti* n. sp., a Natural Enemy of the Cochineal Insect *Chrysomphalus dictyospermi* in Spain** (1). — MALENOTTI, E., in *Redia*, Vol. XII, No. 1, pp. 181-182. Florence, September 21, 1916.

A systematic description of a new Chalcid, *Signiphora merceti*, obtained by breeding specimens of *Chrysomphalus dictyospermi* from Spain.

Three females of this Chalcid have beene xamined, but the male is still unknown. The new species is named after MERCET the entomologist.

1246 - **Observations upon *Icerya purchasi* and its Natural Enemy *Novius cardinalis* in Sicily** (2). — DE GREGORIO, A., in *Il Naturalista Siciliano*, Vol. XXIII, N. S., Nos. 1-6, pp. 5-17, Pl. I-IV. Palermo, 1916.

*Icerya purchasi* Mask. has recently been found at Villabate (Palermo) and the writer has been able to follow out the various stages in its development.

The larvae are able to move with great force and rapidity, and moreover they can be kept alive for several days without food.

The writer confirms the statement that *Novius cardinalis* Muls. is very useful in keeping down the numbers of *Icerya*. He introduced specimens of *Novius* at Villabate which had been received from the Zoological Laboratory at Portici (Naples). Other specimens had previously been introduced at Bagheria (Palermo), and the writer believes that they had multiplied with great rapidity and had helped on the destruction of the cochineal insects at Villabate. He also thinks it probable that another of the Coleoptera, *Chilocorus bipustulatus* L., is useful in the same way and has also helped to stamp out *Icerya* at Villabate. The development of *Novius* is described in this paper. The statement that the adults feed upon the eggs and young larvae of *Icerya* is contradicted.

The writer has shown that the young larvae of *Icerya* are quickly killed by spraying the under surfaces of the leaves of the plant host with soap-suds.

1247 - **Prevention of the Hessian Fly (*Cecidomyia destructor* = *Mayetiola destructor*) in Kansas by Choice of the Season for Wheat Sowing.** — See No. 1179 of this *Bulletin*.

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(1) See also *B.* October 1916, No. 1140. (*Ed.*).

(2) See also *B.* May 1913, N° 621. (*Ed.*).

1248 - **Animal Pests of Rice in Java.** — See No. 1229 of this *Bulletin*.

1249 - ***Helopeltis* and its Relations to Cacao Trees.** — ROEPKE, W., in *Mededeelingen van het Proefstation Midden-Java*, No. 21. Batavia, 1916.

During the years 1901 and 1902 a very severe drought in Central Java was accompanied by the presence of *Helopeltis* on Cacao trees. During the following years when there were heavy rains the pest was much less severe, but it again became serious during the years 1913, 1914 and 1915 which were unusually dry. The harm done led the writer to resune his researches on *Helopeltis*.

There are two species, *H. antonii* and *H. theivora*, which attack cacao plantations. They resemble one another closely both in life history and in the damage they do.

The female lays her eggs in parts of the tree where there is abundant moisture, *i. e.* in the rind of the fruits, the young shoots, or even in the parts of the stems which are not woody. Soon, a black patch appears at the place where the eggs are laid, caused by necrosis of the surrounding tissues. After 6 days the larvae hatch out and scatter over the branches in search of food. Ten days later they are mature.

The places at which the insect feeds soon turn black and normal growth ceases. The writer gives a list of the trees attacked by *Helopeltis*, in which both wild and cultivated trees figure.

*Helopeltis* flourishes best in shady damp places ,and for choice attacks trees which are not exposed to the sun. An account is given of the conditions which favour the insects' dispersal and also of the relations that exist between ants and *Helopeltis*.

For more than 10 years the writer has observed that whenever the black cacao ants (*Dolichoderus bituberculatus*) occur in great numbers *Helopeltis* disappears. He therefore suggests that the pest should be dealt with by encouraging the presence of these ants in the plantations by providing them with suitable nests hung from the trees. Another effective way of checking the spread of *Helopeltis* when the attack is not severe is by catching the insects.

Where the attack is widespread and the insects are numerous it is a good plan to burn the fruits and the stalks.

1250 - ***Eurytoma* sp., an Hymenopteran Pest on Almond Trees in Palestine.** — AHARONI, J., in *Der Tropenpflanzer*, Year 19, No. 6, pp. 317-322. Berlin, 1916.

The larva of *Eurytoma* sp. causes very extensive damage to almond trees in Palestine, 50 per cent of fruits being destroyed every year.

When an almond is attacked it turns first brown and then black and is in consequence unsuitable for food. The larva does not live at the expense of one of the enemies of the almond tree but by destroying the fruits themselves. However in 600 blackened almonds 3 larvae of one of the Microlepidoptera have been found and one of a Curculionid, but it is not likely that they were hosts of the *Eurytoma* larvae. Nevertheless the writer does not believe that the presence of *Eurytoma* alone causes the blackening of the almonds, for many fruits which are black outside contain a normal, healthy kernel.

After the flowering season of the tree (end of February to beginning of March) the adult insect leaves the almond to attack the ovaries of new fruits. Almonds with two kernels invariably contain two larvae.

The writer has never found an egg of *Eurytoma* though he has examined numerous fruits; towards the end of May the fully grown larvae have already appeared.

The white larva is blind, without legs, with the head but slightly developed and a body which is round in the middle but pointed at either end. When it is taken from the fruit and exposed to the sun it rolls up and dies, which proves that it cannot bear the direct rays of the sun. Inside the body a green liquid is produced, both in the larvae feeding on the green almonds and on the ripe white kernels. Apparently these larvae have great powers of resistance against changes of climate for all those raised in the laboratory developed quite normally. Onfy 1 per cent of the larvae in the fruits were dead. This insect seems to have few natural enemies which explains why it has been able to invade Palestine to such an extent. The varieties most liable to attack are Victoria and Princess, both of them bearing fruits with soft shells.

In the Arabian almonds with hard shells the writer has discovered other pests, notably the larvae of one of the Diptera. *Eurytoma* seems to prefer the old trees.

When the harvest time arrives (middle of July to beginning of August) the kernel has been completely eaten, but the larva remains in the almond until the following spring (February or March); it resists the winter cold quite well.

Experiments have been conducted to determine what influence temperature has upon the insect's development. If almonds containi :g larvae are kept in a dark place at a temperature of 17°-18° C., the adults are hatched out at the end of May instead of in February or March. Generally hatching takes place between 8 and 9 in the morning when it is very hot. The insects secrete a liquid to dissolve the shell of the fruit, and this makes a hole through which the adult insect emerges. The females make larger holes than the males, which perhaps affords one means of distinguishing between the sexes.

When there are two kernels and each contains a larva, the insects come out by two different holes. The writer has sometimes found that one kernel contains an adult insect just about to hatch out, while the other contains quite a young larva. Therefore it is evident that the two eggs were deposited by different insects.

Loss of juice from the almond does not hinder the insect's development.

The pupal stage lasts on an average for 2 or 3 weeks; during this time the white grub gradually turns black.

The insect can only be kept in check by picking and burning all the fruits which have turned black, but from which the adults have not yet escaped.

1251 - ***Blastophaga ghigii* n. sp., and *Pleistodontes froggatti*, Chalcid Hymenoptera from Australia Living on the Fruits of *Ficus stenocarpa* and *F. macrophylla* Respectively.** — GRANDI, G., in *Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore d'Agricoltura in Portici*, Vol. XI, pp. 145-159, Fig. I-V. Portici, September 7, 1916.

The writer describes from the systematic point of view two Chalcids collected in 1912 by F. SILVESTRI in New South Wales:

1) *Blastophaga ghigii* n. sp., living in the fruits of *Ficus stenocarpa* F. Muell., at Narara; the female is not known;

2) *Pleistodontes froggatti* Mayr., which lives in the fruits of *F. macrophylla* Desf., at Sydney.

1252 - ***Eriophyes* n. sp., a Mite Pest on Litchi (*Nephelium Lit-chi*) in the Hawaian Islands.** — O' GARA, P. J., in *Science*, N. S., Vol. XLIV, No. 1126, p. 142. Lancaster, Pa., 1916.

In the grounds belonging to the United States Experimental Station at Honolulu a plant of *Nephelium Lit-chi* Cambess. (= *Litchi chinensis* Sonner.) was seriously attacked by a mite, recognised later as a new species of *Eriophyes*.

In some cases the whole of the under surface of the leaves was attacked, but more often the disease appeared in distinct patches. Leaves which were severely attacked resembled peach leaves which have fallen a prey to *Exoascus deformans*.

The appearance of this pest always seems to be unexpected, it is never reported until the signs of its presence are well established.

Hitherto no other mite has been recorded upon *N. Lit-chi*; and moreover very few mites are recorded from China to which this tree belongs. It is possible that although *N. Lit-chi* is imported from China it has been attacked later on by a mite which is indigenous to the Hawaian Islands.

ALFREDO RUGGERI, *gerente reponsabile*.

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (*Ed.*).

FIRST PART

# ORIGINAL ARTICLES

## Olive-Growing and Production in Spain

by

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### ANTIQUITY AND DISTRIBUTION OF OLIVE-GROWING.

The cultivation of the olive in Spain is contemporaneous with the earliest development of the arts of civilisation. The oil obtained in the districts near the coast appears to have been one of the first articles of commerce dealt with by the Phoenician and Carthaginian colonists. As the use of olive oil by the native population became general, the cultivation of the tree increased in all districts which offered favourable conditions and especially in Andalusia where olive-growing was first started and where it has since preserved its greatest importance. The high prices of the oil, due to the difficulties of transport, encouraged the planting of the tree in the interior of the country where it is now established as far as the southern slopes of the mountain ranges (Sierra de Gredos and Sierra de Guaderama) which cross the central plateau and form for this plant an impassable barrier.

The olive-growing districts in Spain do not form a continuous region limited by lines of latitude or by definite isotherms. As the result of the mountainous nature of the country the limits of the district are variable in these respects, and localities, which are specially well-wooded naturally, may be included even if situated at altitudes higher than the tree will usually tolerate.

Olives are grown in thirty-six of the forty-nine Spanish provinces ; they are not grown in the following provinces : — Pontévédra, Léon, Zamora, Valladolid, Ségovia, Soria, Palencia, Oviedo, Burgos, Santander, Biscay, Guipuzcoa and the Canary Islands. As the area devoted to olive-growing in the provinces of Lugo and Orense is only 407 acres it is evident that the

olive-growing region is limited by the central mountain ranges already mentioned which cross the plateau from W. S. W. to E. N. E. and meet the Iberian Mountains in the N. E. Beyond the latter range the north-eastern olive-growing districts are found in the lower part of the basin of the River Ebro and include the whole of the provinces of Navarre and Alva. In the north-western provinces and on the plateau of Old Castille the olive is not grown but it is thoroughly established in the basins of the Tagus, the Guadiana, the Guadalquiver, the Ségura and the Ebro.

The soils on which the olive is grown vary greatly, as do the geological formations from which these soils are derived. Most of the soils are formed from the remains of Cretaceous and Jurassic strata, from the Silurian slates of the Iberian Mountains and central ranges, from the Triassic sands and sandstones, and from the conglomerates, sands, sandstones, and gypsum beds of the Miocene which occur in the province of Alcaria and on the low plains of Aragon and South Castille (La Mancha). These olive-growing soils are comparatively rare in the valleys ; the hilltops and slopes are the situations in which they are characteristically found. It may briefly be stated that in such situations the soils which are formed either *in situ* or from transported and partially broken down materials of a pebbly and stony character, which lack spring-water and usually contain a large proportion of calcium carbonate are undoubtedly in a bad condition for the cultivation of cereals but are well adapted to the growth of trees of the type of the olive.

As the result of these geographical features the olive-growing districts are found at altitudes above that of the irrigation canals and at present only 177 300 acres of olive groves are irrigated that is about 4.7 per cent of the total area under olive trees.

The provinces in which the tree is grown comprise not less than a third of Spain, and in this wide-spread district it is natural that the growth and yield of the tree should vary considerably. The changes in the environment of the plant in this extensive and mountainous country are numerous and have given rise to the many varieties known in Spain.

The study of these varieties have been the object of many experimental trials ; special mention should be made of the work carried out in Andalusia by M. Rojas Clement y Martinez Robles and of that of Dr. Colmeiro who has lately collected eighty varieties of which pictures are to be seen in the nursery of the Botanical Garden Madrid.

### Chief varieties grown in Spain.

*O. europea pomiformis* Clem. (" Olivo manzanillo ").— The tree is well developed, the branches are long with plentiful shoots and the leaves are large. The fruit is symmetrical and almost spherical and of a light purple colour when ripe ; it is largely used in tanning and gives an excellent oil. This variety is cultivated in almost all the olive-growing provinces on account of its excellent yield, in spite of the fact that the yield is irregular from one year to another (vecera) and that it requires to some extent special soil conditions.

*O. e. Columella* Clem. (" Carasqueño "). — The tree is small, the branches are few and the leaves narrow. The large fruits are almost spherical and are borne in clusters of three or four ; the colour changes from red to dark purple when the fruit is ripe. This variety is only suitable for certain soils and is liable to the attacks of insects.

*O. e. Ceraticarpa* Clm. (" Cornezuelo "). — The tree is well developed ; the fruit which is borne singly is curved and ripens somewhat late ; the oil is of good quality but limited in amount. This variety is very resistant both to cold and drought.

*O. e. rostrata* Clem. (" Picudo " or " Cornicabra "). — The tree is large and the branches are well developed ; the leaves are elongated and the upper surface is dark grey in colour. The fruit, which is cylindrical, but tapers towards the end, has a curved tip and is larger than that of the preceding varieties. This variety is hardy and considered very fruitful in Aragon.

*O. e. Banqueri.* (" Lechin " or " Pichelin "). — The olives are small oval and somewhat curved ; they are equally suitable for the manufacture of pickles (Olives de Cuquillo) and for the extraction of oil. The variety is hardy and yields a good crop.

*O. e. Alba* (" Salceño " or " Varal blanco "). — The tree is large with numerous branches and, as the lower surface of the leaves rather than the upper is exposed to view, it has a light aspect to which its name is due. The fruits, which are small are borne in clusters and enclose a relatively large kernel or pit.

*O. e. racemosa* (" Arbequin " or " Racimal "). — The tree is of medium size with drooping branches. The blackish fruits yield a large quantity of oil good in quality. The variety begins to bear fruit after a short period of growth but gives an irregular yield from year to year.

*O. e. nigricans* (" Empeltre "). — The tree is not large except in rich soils ; the leaves are long and narrow ; the fruit is round and yields a large amount of excellent oil. This variety begins to bear fruit as a comparatively young tree ; it is hardy and is valued for these qualities in the province of Tortosa and in other districts of the Ebro.

*O. e. maxima* Clem. (" Morcal "). — The tree is large and the olives are big, oval, rounded at the base and flecked with white. The fruit is used both for the extraction of oil and for preservation in salt water (verdeo). The yield is low and the tree bears only at a comparatively late age.

*O. e. viridula.* Gouan. (" Verdal "). — This variety is a smaller tree than the preceding ones ; the branches are long and the leaves small ; it is also somewhat tender. The single fruits are large and oval and are preserved in salt water.

*O. e. regalis* (" Real sevillana "). — This variety is chiefly found in Andalusia ; the leaves are large and elongated and the fruit, which is the largest of all the varieties of olives, is nearly round and blue black when ripe. This is almost exclusively a table fruit and its cultivation has been very lucrative in lower Andalousia.

*O. e. argentata.* Clem. (" Moradillo " or " Nevadillo blanco "). — The tree is large and the fruits are almost spherical and dark purple in colour.

The yield is plentiful and the oil is equally satisfactory in quantity and in quality.

*O. e. sorianea* (" Nevadillo negro "). — The tree is of medium size the upper surface of the leaves is dark green and the lower a mother-of-pearl white. The fruit is similar to that of " Moradillo blanco " and of good quality.

*O. e. hispidensis* (" Gordal " or " Ocal "). — This olive-tree is large ; and bears at an early age ; the branches are strong and lustrous and the leaves are large. The fruit is almost as large as that of the Sevillano and the tip is pointed ; it is greyish when ripe, forms a good table fruit and yields oil satisfactory in quality and quantity.

*O. e. gienensis* Colm. (" Javaluno "). — The tree is well-developed and bears large elongated olives.

*O. e. ovata* Clem. (" Tachuno castellano " or " Cirujal "). — The tree is of medium height ; the branches are long and bear plentiful side shoots ; the leaves are narrow and long. The small oval fruit ripens early and gives a very fine quality of oil.

*Other less common varieties.* — Among these may be mentioned " Colchonudo " " de Arola " " Tempranillo " " Rodonillo " " Bellotudo " " Bermejuela " " Nogral " " Verdaleja " " Madrileño " " Ojo de liegre " which have been described by M. Colmeiro in his work, to which reference has already been made. There are other varieties in addition to these which might also be mentioned, but, as they have not been clearly classified, it is possible that they may prove to be merely local names for varieties which have been already described.

## Methods of cultivation.

Although the olive is grown extensively in Spain, its cultivation, in comparison with that of other important crops, has been little studied and cared for. During the last few years, however, a tendency to improve the methods of cultivation has been observed.

The plant is usually propagated by cuttings which are permanently planted. In the province of Valentia and in parts of Andalusia the cuttings are planted singly ; in the majority of the provinces several cuttings are planted on the same spot, and these give rise to a number of shoots of which three or four are preserved, allowed to grow and trained in a definite manner. In the eastern provinces the practice of planting cuttings in nurseries is spreading.

As regards tillage the land is ploughed three or four times usually between the end of the winter and the summer. Care is taken that the direction in which the land is ploughed on each occasion crosses that direction in which the work was carried out on the preceding occasion, Tillage at the foot of the trees is carried out by hand and takes place at two seasons in the year. In the southern districts a ditch is dug round the trunk in the autumn to collect rain water and in the spring the soil round the trunk is thrown up to form a mound (" aporcando "). In other

districts the process is reversed ; in the autumn a mound is thrown up round the tree as a protection against drought and in the spring the mound is destroyed.

Manures are very little employed in olive-growing. Up to recent years only the olive-groves in the neighbourhood of towns received a little dung. Today superphosphate is used in Andalusia and in the province of Valentia while some more advanced agriculturists have begun to employ complete mineral manures.

As regards pruning there are no definite regulations. Ten or twelve years after the planting of the cutting the branches of the tree are first pruned but with great moderation ; only after twenty or twenty-five years are the trees thoroughly pruned at regular intervals. In the eastern provinces, in Aragon, Navarre, and Catalonia, pruning is carried out every two years ; in Andalusia every three or four years ; in New Castille every six years. The number of branches suppressed is variable. In many parts of Andalusia, the pruning of the young shoots under the name of " tala " is very thorough and is followed in the next year by the removal of the superfluous older branches. Every thirty or forty years the trees are heavily trimmed and a new surface of wood exposed ; this process gives new vigour to the tree and is carried out successively on the different stocks of each olive grove.

The different practices observed in this work are probably due not merely to local custom, but partly to local variations in growth as the result of the diverse climatic conditions, and of the use of different varieties of the tree.

In the warmer regions the fruit is gathered in the autumn months ; in the other districts in the winter. As a rule gathering takes place later than is necessary to obtain a good quality in the fruit, but this mistake is being corrected in the chief centres of production.

In almost all Andalusia the fruit is knocked down with long poles and the practise is justified by the great height of the trees ; an exception is made for olives which are destined for table fruits. In the central districts hand-picking is known as " ordeno " — a word which is also employed for the milking of cows goats etc.

More than half the olive groves in Spain are cultivated without the presence of another crop. Where the nature of the soil is suitable, cereals, the vine, the almond and the hazel are grown with the olive. Cereals and the vine are the crops usually found in the olive groves ; but the almond is predominant in the east and the hazel in Catalonia.

## Development and present condition of the olive production.

The modern development of olive growing in Spain has been very slow in comparison to the progress made in the cultivation of other crops such as the vine and the orange. " L'Annuario estadístico de España " in 1858 gives the area devoted to olive-growing as 2 080 226 acres.

The " Estadística de la riqueza territorial " published in 1879 shows that this area had decreased to 1 972 877 acres.

In the " Avance sobre la producción del Olivo " published by the " Junta Consultiva Agronómica " in 1888 the area under olive groves is given as 2 849 932 acres.

In 1897 the « Estadística del Servicio agronómico » gives the total area as 304 941 013 acres and in 1903 the publication of the same department shows that the area has increased to 3 293 258 acres.

According to the " Avance estadístico de la riqueza que en España representa la producción media anual del Olivo y otras cosechas " which has recently been published by the " Junta Consultiva Agronomica ", the average area under olives for the period 1904 to 1912 was 3 400 070 acres.

Finally the " Estadística de las producciones viticola y olivarera en el año 1915 " published by the same body gives the area as 3 659 644 acres.

It can be seen from these figures, that the area under olive groves is increasing and has been doubled in 57 years. Of the thirteen agricultural districts into which Spain is divided Western Andalusia has the largest olive growing area with 1 229 578 acres, followed by Eastern Andalusia with 758 428. At present these two districts contain more than half the olive growing acreage in Spain.

The yield per acre varies very much from one year to another. A comparison of the average yields of various periods does not clearly conform to the law of variations which might be applied. The average production in the ten year period from 1891 to 1900 was 8 049 lbs. per acre, that of the following fifteen year period was 14 556 lbs. per acre; from 1906 to 1910 the average yield was 12 259 lbs. per acre, and from 1911 to 1915, 16 326 lbs. per acre.

The value of the olive production has gradually increased The figures given in the " Avance estadístico de la Junta Consultiva Agronomica " which summerises the financial returns of the period 1903-1910 are the following:

| | £ |
|---|---|
| Average value of the oil | 9 523 032 |
| Average value of the green olives | 305 361 |
| Average value of the leaves used as fodder | 492 219 |
| Average value of the wood as fuel | 323 907 |
| Average value of the residues of the fruit | 665 163 |
| Average value of the oil for tanning | 209 126 |

In the south and east of Spain the cultivation of the olive is being developed and is very prosperous; but in these districts large areas are found, suitable for new plantations, which are still uncultivated.

The economic returns from the areas in cultivation could be improved by the expenditure of increased capital and care in the planting, maintaining, manuring of the groves. Such expenditure, as experience has clearly shown will be amply repaid by the tree.

The most urgent needs of the olive industry are a scientific study of all varieties in regard to the nature of the fruit and oil and to the conditions which affect the growth of the tree ; a similar study of the methods of propagation with special attention to the effects of the various forms of grafting ; and a general and determined effort to cope with the numerous parasites and pests to which the tree is liable. These important tasks should engage the attention of the State, and of the societies of olive planters.

To the sphere of political economy should be assigned those measures needed to protect the pure olive oil against the competition of inferior foreign oils, and against adulteration and blending to which the decrease in exports to foreign markets are largely due.

These measures are of importance to all countries in which olive-growing is a fundamental industry.

SECOND PART.

# ABSTRACTS

## AGRICULTURAL INTELLIGENCE

### GENERAL INFORMATION.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

1253 - **Agriculture and its Allied Industries in Rumania.** — XENOPOL N., in *Le Mouvement Economique*, Vol. XXIII, No. 136, pp. 125-154; No. 138, pp. 191-209. Bucharest, April 1 and June 1, 1916.

Since the Treaty of Adrianople in 1829, the production of cereals has become the most important feature in Rumanian agriculture. Up to that time Rumania's chief exports consisted of animal products *i.e.* cattle, wool, wax, wine, salt, hides and salt fish. But after 1829, when she obtained a new outlet for trade via the Black Sea, the character of her agriculture began to change and arable farming gradually displaced the old stock raising industry.

At the present day wheat is the chief crop and occupies an area of 5 million acres. The grain produced is of the finest quality, but the yield is very low (12 to 20 bushels per acre during the past 10 years) and might well be increased 50 per cent by improved methods of cultivation, including the use of artificial manures, and by a better utilization of the available water supplies. Exports of wheat during the years 1911 to 1913 were valued from £8 000 000 to £10 000 000 per annum and amounted to one half of the total exports of cereals. The Rumanian people eat very little wheat; out of a total population of 8 millions only about 2 millions consume it regularly, the staple food of the people being maize.

According to the official returns the gross value of the Rumanian crops in 1914 was as follows:

| | £ |
|---|---|
| Cereals | 40 078 000 |
| Pulse and root crops | 2 768 000 |
| Fodder crops | 3 688 000 |
| Market-garden crops | 979 000 |
| Oil seeds | 618 000 |
| Other crops (fibres etc.) | 533 000 |
| Total | 48 664 000 |

There is a disproportionate amount of cereals grown in the country and it is questionable whether it be good policy to allow the cultivation of wheat and maize to replace grass to such a large extent. The vast area under wheat is no doubt a direct response to the good prices obtained on foreign markets, but the same cannot be said of maize which fetches a much lower price, and its continued growth on a big scale must be attributed in a great measure to the traditional habits of the Rumanian peasants.

The distribution of the area amongst the different sized holdings is given in the adjoining Table. Nearly half the land is in the hands of peasant proprietors and of the other half, four fifths consist of large holdings and estates, while medium-sized farms only occupy 10 per cent of the total area. The peasants, besides owning half the agricultural soil in the country also hold a great part of the estates, paying rent either in cash or in kind. But the disadvantages of this system of land tenure are evident in the low standard of cultivation and the absence of proper buildings, which prove that the land is being worked with insufficient capital.

*Distribution of area amongst the different sized holdings.*

| Size of holding | No. of holdings | No. of holdings per cent of total no. | Area occupied | Area occupied per cent of total area |
|---|---|---|---|---|
| acres | | | acres | |
| Under 1 1/4 | 62 832 | 6.60 | 65 000 | 0.34 |
| 1 1/4 to 2 1/2 | 81 039 | 8.50 | 180 000 | 0.93 |
| 2 1/2 » 5 | 147 900 | 15.20 | 586 000 | 3.01 |
| 5 » 7 1/2 | 131 630 | 13.60 | 834 000 | 4.30 |
| 7 1/2 » 10 | 172 446 | 17.90 | 1 564 000 | 8.08 |
| 10 » 12 1/2 | 148 717 | 15.40 | 1 759 000 | 9.08 |
| 12 1/2 » 17 1/2 | 131 145 | 13.50 | 1 840 000 | 9.50 |
| 17 1/2 » 25 | 45 230 | 4.70 | 975 000 | 5.05 |
| Total under 25 acres | 920 939 | 95.40 | 7 803 000 | 40.29 |
| 25 to 125 | 36 318 | 3.70 | 1 722 000 | 8.89 |
| 125 » 250 | 2 405 | 0.26 | 413 000 | 2.13 |
| 250 » 1 250 | 3 314 | 0.41 | 2 020 000 | 10.43 |
| 1 250 » 2 500 | 1 122 | 0.13 | 1 987 000 | 10.26 |
| 2 500 » 7 500 | 771 | 0.09 | 3 060 000 | 15.80 |
| 7 500 » 12 500 | 112 | 0.01 | 1 077 000 | 5.55 |
| Above 12 500 | 66 | 0.00 | 1 287 000 | 6.65 |
| Grand total | 965 047 | 100.90 | 19 469 000 | 100.00 |

Very little land is held by foreigners in Rumania. Article 7 (§ 5) of the Constitution (revised on October 13, 1879) lays down that " only Ru-

manians born or naturalised, may acquire rural property in Rumania". This did not interfere with foreign owners who were already in possession in 1879, but such owners are no longer numerous for many sold out their properties as the price of land rose.

While exports of cereals have been increasing, those of animal products have decreased from about £2 000 000's worth in 1879 to £116 000's worth in 1913. All Rumanian exports are of an extremely bulky nature while the imports consist of expensive products which occupy little space. Also, many raw materials such as hides and wool are exported and then reimported again as manufactured articles. Both these facts point to the necessity of establishing national industries.

So far nothing has been done with regard to the regulation water systems, and it is only within the last few years that a proper scheme of forest management has been in force. Improved means of transport are badly required for there are only 2200 miles railways on an area of 89 000 square miles. With regard to the important question of the storage of cereals, while the building of the docks at Braila and Galatz has furnished the necessary accommodation for all corn awaiting shipment, the rest of the country is still unprovided with warehouses. These should be established by the Government at all the principal railway stations for the purpose of collecting and grading cereals. By this means a farmer would then be able to raise cash on his harvest while awaiting the best opportunity for marketing his corn.

The condition of the peasants is still unsatisfactory in many parts of Rumania though measures of reform have already been takes, *e.g.* the establishment of rural banks, State aid for the purchase of land, the foundation of peasant societies. An agrarian law passed in 1908 regulated certain agricultural payments : a minimum wage was fixed for labourers and a maximum price for rent. Communal fields have been established where the cultivation of fodder crops will be given every encouragement. Proposals have also been made with regard to the compulsory breaking up of large estates for the purpose of increasing the number of small holders.

Turning to the agricultural industries : A capital of £1 640 000 is invested in flour mills with a plant of 22 120 HP, yet the exports of flour only amount to 7 per cent of the corn. The manufacture of woollen materials is carried out in 13 factories (3 162 HP), which only deal with the coarser kinds of wool and are nothing like sufficient to meet the requirements of the country. Finer qualities of goods are imported in large quantities. The industry could well be expanded if the home production of wool were more abundant and of better quality. But for some time past the number of sheep in the country has been diminishing and little is being done to improve the fineness of the wool. At the model farm at Laza, it is true, some experimental crosses were carried out between the native breeds Tzigae and Frise; and the Ministry of Agriculture imported some Merinos to the Royal estates, and crossed them with local sheep with excellent results so far as the wool was concerned. These, however, are only isolated trials and have no effect on the sheep of the country whose fleece

still remains of a very poor quality. The hemp and linen industries are of little importance and only represent an invested capital of £81 000; the greater part of the hemp produced is exported. The sugar industry which dates back as far as 1873 is somewhat on the decline as the farmers have given up growing sugar beets in favour of more paying and less troublesome crops. The present area under beets is about 35 000 acres and the yearly production of sugar varied from 200 000 to 300 000 tons in 1909 to 1913.

Of the Rumanian forests, which cover 20 per cent of the total area of the country, the State owns some 2 600 000 acres while 4 000 000 acres are private property. The forest industries are in the hands of 14 big companies from whose books the following data have been summarised to give some idea of the total vested interests engaged.

| | £ |
|---|---|
| Ordinary shares | 2 628 000 |
| Debentures | 639 000 |
| Working capital (1913 balance sheet) | 8 112 000 |
| Buildings and plant | 1 555 000 |
| Reserve funds | 84 000 |
| Sinking funds | 717 000 |
| Net profits (1913 balance sheet) | 272 000 |
| Return on capital | 1.8 to 33 per cent (2 companies show a loss) |

A few forest societies have been formed among the peasants, but as they are working without much capital their output is still low. The lack of roads and railways makes the forests very inaccessible and the preparation of transport routes is a heavy initial expense for small associations. Charters have also been granted to two foreign companies (with capitals of £111 000 and £880 000) for the working of Rumanian forests.

There are in all 71 saw mills in the country which employ 12 000 men. Another 50 000 men are occupied with felling the trees and transporting them to the mills. A large proportion of the timber (valued at £940 000 in 1913) is exported, but at the same time Rumanian imports of wood and wood products amount to £620 000 per annum of which the greater part consist of manufactured articles. The paper-making industry is important and represents an invested capital of £1 020 000. It deals annually with £103 000 worth of raw material of which about one third is imported, and produces paper and cardboard which amounted to 18 200 tons in 1914 and was valued at £432 000. No paper is exported, but 3 600 tons of pulp (valued at £32 000) went abroad in 1913.

1254 - **Testing, Storage and Preparation of Unpolished Rice (bras pitjah koelit).** — Ottow W. M., in *Natuurkundig Tydsckrift voor Nederlandsch-Indië*, Part LXXIV, pp. 143-196. Batavia, 1916. RURAL HYGIENE

In connection with the importation of unpolished rice for preventing and restricting beri-beri in the Dutch Indian Army questions arose as to the testing, the storage and the treatment of the above named form of rice,

which have led to the writer's investigations. The results of the investigations are summarised by the writer as follows:

1. — On the ground of taste, no reasonable and still less insurmountable objections can be made to the use of unpolished rice which offers sufficient protection against beri-beri.

2. — Compared with finished rice, unpolished rice becomes easily and speedily unfit for consumption, by decay, by damages done by insects, etc. Although periodical exposure to diffused daylight and regular turning over of the stock have a favourable influence with regard to dete rioration during storage, still unpolished rice can scarcely be kept for longer than two months without even quite perceptible alterations.

3. — The necessity of preserving unpolished rice, which must be kept for some time, is best practically met by the use of chloroform or carbon tetrachloride. These are applied in the form of vapour, for which comparatively small quantities are sufficient. They do not modify the hardness, the smell or the taste of the rice, and they exercise a favourable influence on the preservation of the desired activity.

4. — The $P_2 O_5$ proof with the fixed amount 0,4 % of this substance is not sufficiently to be relied upon when testing rice as to its value as protective against beri-beri.

5. — A new method of chemical investigation better enables us to judge of this value. This method consists in the estimation of the spirit dry-residue, according to a process which has been fully described in the text. As criterion the dry-residue limit was to be fixed between 0,55 and 0,6 %.

6. — The physiological test with the help of test-animals is at present the only one which leads to a never-failing, always correct judgment. The evident suitability of rice-birds for this purpose has led to a method of investigation which in every respect deserves recommendation.

7. — It appears more and more distinctly that requirements for an adequate activity of rice are completely worthless, if at the same time certain stipulations are not made as to the treatment of the rice, viz. the washing and steaming, processes to which the rice must be subjected before it is ready for consumption.

A specimen has been found with a $P_2 O_5$ amount lower than the standard norma of 0,4 %, and which notwithstanding this was sufficiently active.

This example shows that there are kinds of unpolished rice to be obtained which in appearance and taste differ little, if anything from entirely polished rice, and which still give more than sufficient protection against beri-beri.

AGRICULTURAL EDUCATION

1255 - **Agricultural Instruction by Correspondence in France.** — LINDET, in *Comptes Rendus de l'Académie d'Agriculture de France*, Vol. II, No. 32, pp. 931-993. Paris, 1916.

In October 1913, the Union of Agricultural Syndicates in the south-east of France began a course of agricultural instruction by correspondence. During its first year as many as 207 pupils were registered, but with the out-

break of war those left on the land were deprived of all leisure, and the number of pupils fell to 54 in 1914-1915 and to 34 in 1915-1916.

At the beginning of each month from October to April every member of the course receives instructions for work, in the carrying out of which he is encouraged to get what help he can from his parents or from a local "monitor" appointed by the Union. The work includes:

1) A course of reading for which books are provided in local libraries or obtainable from the Union at a very low cost.

2) The setting up of a small experimental ground where each pupil can test for himself the effect of manurial dressings, of early or late sowing, etc.

3) The carrying out of simple experiments such as the germination of seeds, the relationship between the density of potatoes and their starch content, the flocculation of clay by lime, the effect of sodium nitrate on tillering and straw production, the topping of sugar beets, the washing of vine poles.

4) Excursions organised by the monitor to neighbouring farms where the pupils are expected to take notes on the crops, on the live stock, on the implements, etc.

5) The writing of papers in answer to questions on such subjects as the nature of the local soils, the crops of the districts and their industrial uses, the treatment of seed, the planting of fruit trees, etc. This branch of the work involves personal effort on the part of the pupil who will have to consult his books in order to find an answer to the questions.

6) The working out of sums on: the price of wheat per given volume from its density and price per quintal (220 lbs); the value of a manure heap, given its composition and the value of each constituent; the price of rations for maintenance or fattening; etc.

Every month the pupils send in their work which must include a report of their excursions and of the progress of their experiments. The papers are corrected and returned, the names of the pupils getting the highest number of marks being published in the monthly sheet of instructions together with remarks of a general nature which apply to all members of the course. When specially good papers are sent in these may even be reproduced in the monthly sheet.

## CROPS AND CULTIVATION.

1256 - **A Detailed Study of Effects of Climate on Important Properties of Soils.** — LIPMAN C. B., and WAYNICK D. D., (Laboratory of Soil Chemistry and Bacteriology, University of California) in *Soil Science*, Vol. I, No. 1, pp. 5-48. New Brunswick, N. J., 1916.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY

In 1908 a set of experiments were started under the joint auspices of the U. S. Department of Agriculture and the Agricultural Experiment Stations of Kansas and California. Two soil blocks, 5 ft. square and 3 ft. deep were moved from each station to the other two stations and placed in position as nearly as possible in the original soil layers. A similar block

of soil was dug up and replaced in its position at every station and a check plot of undisturbed soil was also set aside. It was therefore possible to compare at each station 1) the natural undisturbed field soil; 2) the natural field soil after having been disturbed; 3) the soils from the other two experiment stations. When 7 years later the present writer attacked the problem of the effects of climate on soils, the above plots appeared to provide admirable material for study in this connection, and it was decided to subject them to a physical, chemical and bacteriological investigation.

The most striking change undergone by the transported soils is in their appearance. SHAW and WALTERS originally described the Californian soil as "Sacramento silt loam", the Kansas soil as a "dark heavy loam" and the Maryland soil as a « Light yellow clay ». During the period which has elapsed since the soils were moved, their colour has changed markedly, Kansas and Maryland soils in California becoming of a much deeper reddish colour, and Kansas and Californian soils bleaching to a light or yellowish clay in Maryland. Soils brought to California have also increased their hygroscopic coefficient, their moisture equivalent (1) and their wilting point.

The bacterial investigations show that in general the numbers of bacteria increase when arid soils are put under more humid conditions and decrease when humid soils are brought to a drier climate. Ammonification and nitrogen fixation vary in a similar fashion and so does nitrification with certain forms of nitrogen. The destruction of cellulose, on the other hand, varies inversely with the bacterial numbers.

Chemical analyses reveal marked changes in the acid soluble constituents of soils due to climatic effects. For example the Californian soil increases in lime in Kansas and Maryland (particularly at the latter station) and loses in iron. Though difficult to generalise, the tendency is for soils to increase in iron and decrease in alumina when placed under arid conditions and *viceversa*. Phenomenal losses in certain constituents seem to have occurred in some soils even when the latter were not moved, the Maryland soil losing enormous quantities of magnesia in the given period. With regard to the total water soluble constituents, these increase considerably when the Californian soil is moved to Kansas or Maryland and the same occurs with Maryland soil when moved to Kansas or California.

Some of the effects noted are difficult to explain in the light of our present knowledge, but the causes of other effects stand out quite clearly. For example, it appears that the total internal surface of soils per unit of dry weight increases with the degree of aridity of the climate, and this exercises an important influence on the hygroscopicity, moisture equivalent, wilting point, tenacity, absorbing power and many other physical characteristics of a given soil. With the chemical data the causes for the changes are more difficult to define because of the great irregularity of some of the results obtained. But they indicate clearly that profound

(1) See *R.* Oct. 1916, No. 1059. (*Ed.*)

changes take place in the chemical constitution of a soil when it is moved from an arid to a humid climate or *vice versa*. In general, bacterial activities are far more pronounced under humid than under arid conditions except with regard to cellulose decomposition. This is probably due to the decrease in the carbon of soils under arid conditions and to the decrease in the water soluble substances.

1257 – **The Relationship between the Osmotic Pressure of the Soil Solution and the Growth of Wheat.** — Тулайковъ М. Н. (Toulaikow M. N.) in *Журналъ Опытной Агрономіи имени* П. С. Коссовича (*Review of Agricultural Experiments dedicated to the memory of* P. S. Kossovitch). Vol. XVII, No. 2, pp. 122-163. Petrograd, 1916.

In order to determine the correlation between the salt content of the soil and the growth of plants, a series of experiments were undertaken at the Station of Besentchouk where the alkali soils of the Province of Samara are under special investigation. The osmotic pressure of the soil solution was artificially raised by the addition of mineral salts to the soil and was studied in its relationship to the growth of Bielotourka wheat, a hard spring variety which is widely distributed in the region.

The experiments were begun in 1910 and a first report has already been published (1). Plants were grown in zinc cylinders each of which contained 5 kgs. of black soil (Tchermozem) and about 50 gms. of a mixture of nutrient salts. Before being filled into the pots the soil was dried in the sun till its moisture content had been reduced to 10 to 11 per cent. The nutrient salts were added in the form of solution, but the salts used to raise the osmotic pressure of the soil solution (*i. e.* sodium chloride, nitrate and sulphate; ammonium chloride and sulphate; calcium chloride) were applied in the solid form and in three different ways;

1) The whole amount was mixed with the soil at the start so that the soil solution was immediately brought up to the required osmotic pressure.

2) The salts were added at the rate of one sixth of the total amount per week for 6 weeks. By this means it was possible to reproduce the natural conditions prevailing in alkali soils where the osmotic pressure of the solution increases as the growing season advances owing to the decrease of the water content in the soil. By spreading the applications over 6 weeks, the plants had received the whole amount before flowering.

3) The whole amount was added in a single dressing at the time of flowering.

Distilled water was used for bringing the moisture content of the soil up to 60 per cent of its maximum water holding capacity or in other words to 24 per cent of the dry soil. Selected seeds or pure lines of Bielotourka wheat were employed and careful records were kept of the dates of germination, tillering, shooting, flowering, and ripening. The height of the plants was also measured at different times. When the plants were harvested, the dried grain and straw were weighed separately and the grain was analysed for total and protein nitrogen and for moisture; the

(1) See *R.* 1914, No. 987. (*Ed.*)

weight of 1000 seeds was also determined and their appearance was noted (steeliness or starchiness) (1).

The results of the experiments showed that the osmotic pressure of the soil solution had a marked influence on plant life. This influence was already appreciable when the seeds were germinating and could be followed throughout the development of the plant.

As the osmotic pressure increased, germination was retarded and tillering became less vigorous while the shooting of the corn and flowering were earlier, so that the whole period of vegetation was considerably cut down. An osmotic pressure of 7 atmospheres obtained by the addition of sodium chloride shortened the life of plants by 7 days in 1915 and by 10 days in 1914. The same pressure exerted by sodium sulphate only reduced the period by 4 days and the effect of nitrates were still less powerful, their solutions having no appreciable effect except at higher pressures altogether.

With regard to the development of the plant and the yields of straw and grain, it was found that there existed a definite optimum osmotic pressure for each of the salts tried. The point varied between 1 and 3 atmospheres according to the different salts and was marked by maximum crop yields and by a low ratio of straw to grain. As the osmotic pressure increased above this optimum point, harmful effects became evident, the development of the plant was suddenly checked and low yields of grain and straw were obtained. A rise in the osmotic pressure of the soil solution caused by the addition of all salts except nitrates lowered the ratio of straw to grain.

It was established in the earlier experiments that when the pressure of the soil solution is between 3 and 5 atmospheres, plants are able to make the available water go further than under normal conditions. This conclusion was fully confirmed by the experiments of 1914 and 1915. In Table I are given the mean coefficients of transpiration obtained with the normal soil solution and with solutions whose osmotic pressures varied from 1 to 5 atmospheres. The figures show that in general transpiration decreased as the osmotic pressure increased up to 5 atmospheres. Above that limit a further increase in the osmotic pressure resulted in a coefficient of transpiration higher than that for the normal soil solution. Magnesium chloride did not follow this rule. The fact that Bielotourka wheat uses less water per unit of dry matter produced when the osmotic pressure of the soil solution rises above normal, is of the greatest importance in arid regions where the climatic conditions are similar to those at the Besenchouk Station.

With the soil solution at its optimum osmotic pressure the wheat not only gave maximum yields, but both straw and grain contained maximum amounts of total and protein nitrogen. In other words, the plant was making the best possible use of the nutrient substances at its disposal to produce the largest amount of grain of the best quality. Table II summarises the results obtained in this connection.

(1) See *R.* Sep. 1916, No. 964. (*Ed.*).

TABLE I. — *Effect of the osmotic pressure of the sotl solution on the coefficient of transpiration of wheat plants (average of the two years 1914 and 1915.*

| Salts used | Coefficients of transpiration | | | | |
|---|---|---|---|---|---|
| | Normal soil solution | Abnormal soil solutions, osmotic pressure | | | |
| | | 1 | 2 | 1 | 1 |
| Sodium chloride | 365.6 | 359 5 | 346.6 | 362.8 | 358.4 |
| » sulphate | — | 364.3 | — | 342.6 | 349.4 |
| » nitrate | — | 352.0 | 335.7 | 317.9 | 382.8 |
| Ammonium chloride | — | 329.9 | 323.1 | 295.2 | 364.2 |
| » sulphate | — | 331.4 | 308.3 | 294.7 | 300.1 |
| » nitrate | — | 336.0 | 304.6 | 292.6 | — |
| Magnesium chloride | — | 350.4 | 358.8 | 328.7 | 413.8 |
| » sulphate | — | 366.9 | 360.0 | 343.4 | 359.2 |
| Calcium chloride | — | 347.7 | 329.6 | 341.8 | — |
| Mean for all salts | 365.6 | 348.6 | 333.3 | 329.9 | 314.8 |

TABLE II. — *Effect of the osmotic pressure of the soil solution on the yield and nitrogen content of wheat (average of the two years 1914 and 1915).*

| | Nitrogen of grain | | | | Nitrogen content of grain (per cent) | | | | Total amount of nitrogen per pot | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control (normal soil solution) | = 100 | | | | = 1 | | | | = 100 | | | |
| Osmotic pressure of soil solution in atmospheres | 1 | 2 | 3 | 5 | 1 | 2 | 3 | 5 | 1 | 2 | 3 | 5 |
| *Salts grouped by their bases:* | | | | | | | | | | | | |
| Sodium salts | 112 | 99 | 89 | 57 | 1.12 | 1.29 | 1.41 | 1.58 | 125.4 | 127.7 | 125.5 | 90.1 |
| Ammonium » | 122 | 139 | 121 | — | 1.33 | 1.55 | 1.67 | — | 162.3 | 215.4 | 202.1 | — |
| Magnesium » | 96 | 94 | 82 | 62 | 1.11 | 1.10 | 1.22 | 1.37 | 106.6 | 103.4 | 106.1 | 87.7 |
| *Salts grouped by their acid radicles:* | | | | | | | | | | | | |
| Chlorides | 109 | 108 | 86 | 42 | 1.16 | 1.27 | 1.43 | 1.68 | 126.4 | 137.2 | 123.0 | 69.6 |
| Sulphates | 108 | 111 | 118 | 98 | 1.14 | 1.24 | 1.32 | 1.51 | 123.1 | 137.6 | 155.8 | 148.0 |
| Nitrates | 118 | 120 | 97 | — | 1,30 | 1.62 | 1.73 | — | 160.4 | 194.4 | 167.8 | — |
| Mean for all salts | 110 | 110 | 100 | 65 | 1.18 | 1.33 | 1.43 | 1.68 | 129.8 | 146.3 | 143.0 | 109.2 |

*Conclusions.* — In pot cultures it is possible to regulate the osmotic pressure of the soil solution by the addition of soluble salts (nutrient and otherwise) to the soil and thereby not only to increase the yields of grain and straw above the normal, but also to raise their nitrogen content. The study of the osmotic pressure of the soil solution is of special interest in relation to steppe and alkali soils where it is exceptionaly high and in the case of peat soils and bogs where it is exceptionally low. It may also throw light on the action of "indirect" manures, such as for instance that of sodium chloride which is frequently used on sugar beets. Hitherto its beneficial effect has been looked upon as due to a liberation of potash in the soil, instead of which it might be caused by a simple increase in the osmotic pressure.

It is recommended that the investigations be extended to other farm crops and the effect of the soil conditions determined not only on the nitrogen content of the plant but also on its other constituents, fats, sugars and starch.

1258 - **Investigations on the Microorganisms of Peat Soils, Waste and Cultivated.** — ARND T., in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 45, Nos. 8-25, pp. 554-574. Jena, June 19, 1916.

At the Bremen Station for peat investigations ("Moorversuchsstation"), a series of experiments were undertaken to determine the changes, if any, in the bacterial activity of peat soils brought about by drainage, liming and tillage. Only preliminary trials have as yet been accomplished, but these have already shown that there exists a striking difference in bacterial activity between waste and cultivated land. Soil samples were taken from twelve different parts of the experimental ground and were tested for: ammonification, nitrification, denitrification, the decomposition of cellulose, the presence of *Azotobacter* and the fermentation of mannite. The results may be summarised as follows;

1) Ammonifying organisms were found in all samples, even in the most strongly acid subsoils from waste land. They were far more active in surface soil than in the underlying layers, the actual numbers in the subsoil being very small and their vitality reduced. Ammonia production also occured much more freely with samples from soils which had been tilled, manured or limed than with samples from land of the same type which lay waste. An application of dung to a peat soil which had a very low bacterial content resulted in a considerable and lasting increase in the numbers and activity of the putrifying organisms. The breaking up of waste land only affected the bacterial life in the top 8 in. of soil; samples of subsoil (8 to 16 in. deep.) showed about the same ammonifying power whether taken from waste or cultivated land.

2) None of the samples from waste land contained any active nitrifying organisms, neither did samples from cultivated land which was either unlimed or had only received lime at the rate of half a ton of lime per acre. On the other hand soil which had received one ton of lime per acre exhibited a marked power of nitrification, but it would seem that an even heavier dressing would be required in order to obtain an active develop-

ment of the nitrifying organisms in the peat itself. Not a single subsoil examined, whether obtained from waste or cultivared land, contained any organisms capable of producing nitrites or nitrates.

3) Every sample tested was able to reduce nitrates, the surface soil of waste land being hardly more active in this respect than its subsoil. Where the land was cultivated, however, the reduction of nitrate took place much more readily with the surface than with the subsoil, and the same was true of cultivated surface soils as compared with the surface soil of waste land, more especially where tillage had been accompanied by liming. No differences were obtained in the denitrifying power of the various subsoils.

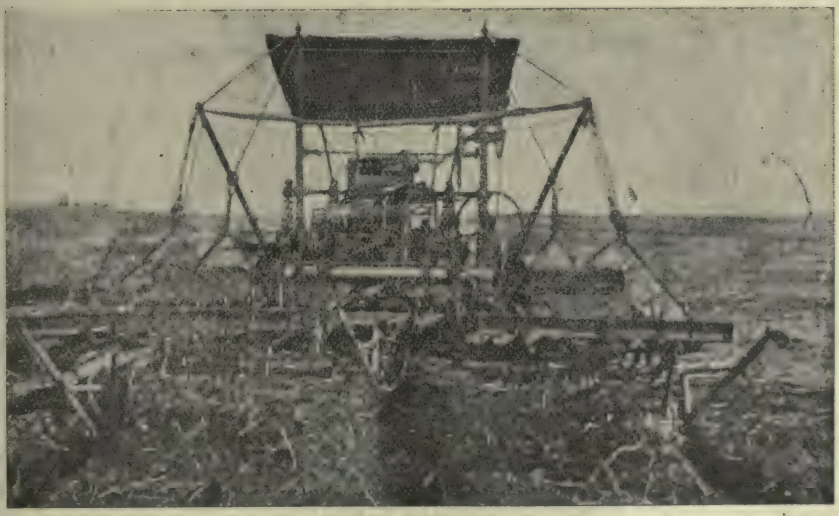
4) All surface soils exhibited a greater power for decomposing cellulose than their corresponding subsoils, the difference being very small in the case of waste land and much larger for cultivated land. Cultivated, limed or manured surface soil was also much more active than waste surface soil. As with ammonification and nitrification, maximum decomposition of cellulose occured when the soil had previously received a dressing of dung.

5) In no sample was *Azotobacter* present. Surface soils and cultivated soils fermented mannite more readily than subsoils and waste soils, tha maximum effect being again obtained with the dunged plot.

OPENING UP LAND FOR CULTIVATION

1259 – **Reclaiming the Everglades of Florida.** — Willey A. W., in *Scientific American*, Vol. CXV, No. 12, pp. 258-259. New-York, September 16, 1916.

In the south of Florida there are some 4 million acres of swamp known as the "Everglades" which are being converted into agricultural land by drainage. An accurate topographical survey of the district had shown that



Machine used for idgging trenches and pulverising the soil.

the swampy condition of the area was due to the Okeechopee lake and that as the rim of the lake was some 20 ft. above the level of the tidal river, the reclamation could be effected by merely cutting canals through the rock rim of the lake and allowing the water to flow away by force of gravity. The first reclamation project which has already been carried into effect included the excavation of 4 canals of a total length of 200 miles and of an average cross section of 5 × 60 ft.; 6 dredges were employed for the purpose. For the making of the smaller ditches other machines were used. One of these is illustrated in the adjoining fig.; it not only dug trenches but pulverised the soil at the same time, moving across the land at the rate of 500 ft. in 10 hours. Another ditcher used was capable of cutting a trench 400 ft. long 6 ft. deep and 3 ft. wide in one day. The total length of the lateral canals amounted to 2000 miles, draining an area of 1 ½ million acres.

The success of the enterprise has been so complete that a second project is now in hand for reclaiming the remaining 2 ½ million acres and will be completed within a year. As soon as the land is ready it is sold by the State Government and divided up into farms, settlers being attracted from all the other parts of the United States.

The total cost of reclamation has been estimated at 4 ½ million dollars.

METHODS OF SOIL CULTIVATION

1260 – **Experiments in the Application of Electricity to Plant Production, in England.** — Ingvar Jorgensen, in *The Journal of the Board of Agriculture*, Vol. XXIII, No. 7, pp. 671-672. London, October 1916.

Experiments on the effect of overhead electrical discharges on crops were continued in 1915, a crop of oats being grown under this treatment at Lincluden Mains, Dumfries.

The crop was grown on ground which had been used for the three previous years for similar experiments with potatoes. The experimental ground consisted of two plots each of 1 ½ acres lying side by side, one of them receiving the electric discharge, the other being used as the control. The two plots were separated by a well-earthed wire screen reaching to a height three feet above the level of the charged network. It was hoped by this means to prevent any considerable leakage of current from the electrified area to the control. Readings of a sensitive electrometer showed that the screen much reduced the amount of discharge reaching the non-electrified area, but it did not do away altogether with the leakage.

The season was a particularly dry one, accompanied by a scorching sun, and as the soil is of a very porous nature the conditions were not conducive to a heavy crop.

From the early stages of growth the crop on the electrified area showed a marked superiority in comparison with that on the control area and did not suffer from the prevailing drought to the same extent.

The discharge was run for 557 hours during 108 days, i. e., an average of 5 hours a day.

The two crops when ready for harvesting were cut, threshed and weighed separately. The weights of the two crops are given below, and

show that the electrified crop, as compared with the non-electrified, showed the remarkable increase of 30 per cent in grain and 58 per cent in straw.

| | Total grain. | Total straw. | Increase of grain. | Increase of straw. |
|---|---|---|---|---|
| Electrified . . . . . | 1 309 lb. | 2 476 lb. | 30 per cent. | 30 per cent. |
| Control . . . . . | 1 008 lb. | 1 572 lb. | — | — |

An analysis of the grain and straw from the two crops was undertaken at the University of Leeds. The figures obtained for the experimental and control crops showed practically no difference apart from those accounted for by experimental error. Feeding experiments are needed before it can be concluded with certainty that the discharge has been without effect on the food value of the oats, but is is extremely unlikely that any difference would be demonstrated between the two crops.

1261 – **The Industrial Uses of Seaweed, More Especially as Manure.** — Gloess P., in *Moniteur Scientifique du Docteur Quesneville*, Vol. VI, Part I, No. 893, pp. 97-108 ; Part II, Nos. 896 and 898, pp. 169-177 and 217-223. Paris, May, August and October 1916. MANURES AND MANURING

The industrial uses of seawed are classified as follows :

I. The general use of seaweed more particularly for manure.
II. The use of plants other than algae, especially grass wrack (*Zostera* spp.) as a source of:
  *a*) fibre
  *b*) paper
  *c*) cellulose
  *d*) potash manure obtained as a bye-product.
III. The use of red algae (Rhodophyceae) for the production of gelose.
IV. The use of the brown algae (Phaeophyceae) especially the Laminariaceae (kelp) which contain no gelose,
  *a*) as a source of algin for the production of :
    I) waterproofing, dressing and gum substances ;
    II) food substances ;
    III) a natural algin product containing iodine ;
    IV) sodium peralginate, a bleaching agent ;
    V) various other materials for industrial purposes.
  *b*) as a source of potash salts ;
  *c*) as a source of other salts ;
  *d*) as a source of iodine and bromine.

*The use of seaweed as manure.* — On the coats of France (Brittany), England, Scotland, Ireland and in the Channel Islands two classes of seaweed are gathered : 1) the kinds that grow between tide marks (*Zostera* spp., red algae and *Fucus* spp.); 2) the drift weed which is washed up from below low-water mark (*Laminaria* spp., *Zostera* spp.). In the districts where it is collected it forms one of the principal manures and enables the land which is naturally poor to become productive.

On the Pacific Coast of the United States large quantities of kelp are harvested annually (1). The writer points out that a certain amount of waste is incurred by not recovering the iodine and bromine contained in the kelp. These elements being more valuable for chemical or pharmaceutical uses than for agriculture, their extraction would seem advisable especially as their recovery would enable the manure to be sold at a lower price.

*The extraction of potash salts from seaweed.*. — The seaweeds used for this purpose consist of *Macrocystis* spp., *Nereocystis* spp. and *Pelagophycus* spp. which form the "giant kelp" of the American Pacific coast, and *Laminaria flexicaulis, L. Cloustoni, L. saccharina, Saccorhiza bulbosa* which are found in Europe. The average chemical composition of fresh European seaweed is as follows:

- Water . . . . 85 %
- Dry matter . 15 %
  - Mineral matter 7 %
  - Organic matter 7 %
    - Potash salts . 4 %
      - Chlorides . . 3.85 %
      - Iodide . . . 0.13 %
      - Bromide . . 0.01 %
    - Other salts . . 3 %
      - Chlorides, sulphates, phosphates of sodium, magnesium, calcium, iron, manganese.

Every year about 100 000 tons of fresh seaweed are gathered in France and 250 000 tons in the United Kingdom and Norway. From the 350 000 tons the following products are obtained: 175 tons of iodine, 7000 tons of potash salts, 15 000 tons of soda ash. By improved methods of manufacture the yield of iodine and potash salts might well be doubled and at the same time 10 000 tons of mineral salts other than potash, 175 tons of bromine and 28 000 tons of raw algin could be produced. With the use of cutters the seaweed harvest could also be increased.

The potash salts, which consist chiefly of the chloride, make up about 4 per cent of the fresh seaweed or 25 per cent of the dry matter. They are extracted by lixiviating the kelp, or may be obtained as an efflorescence on drying the seaweed by heat. The latter process yields a substance containing 65 per cent of potassium chloride (41 per cent of $K_2O$) which may be used as such for manure or subjected to purification as in the case of Stassfurt salts.

*Other salts extracted by lixiviation.* — These make up 43 per cent of the total salts, 3 per cent of the fresh seaweed or 20 per cent of the dry matter. They consist of about 50 per cent of sodium chloride, and 50 per cent of the other salts, and though much less valuable as fertilisers than the potash salts, they are used for that purpose in France.

(1) See *R.* 1912, No. 1147; *R.* 1914, No. 212; *R.* 1915, Nos. 467 and 688. (*Ed.*)

*Extraction of iodine and bromine.* — Inorganic iodides and bromides are easily obtained from kelp by simple lixiviation with weak acid or water. Organic compounds of iodine and bromine on the other hand cannot be completely extracted without destroying the mucilaginous residue unless an oxidising agent be employed in a faintly acid solution, according to the process patented in various countries (France, Germany, Austria, Belgium, England, Norway, United States and Japan).

1262 – **Green Manuring with Leguminous Crops in Java.** — RANT A., in *Mededeelingen van het Kina Proefstation*, No. III. Batavia, 1915.

At Tjinjiroen, in the mountainous region of Java, experiments were carried out on the growth of various leguminous crops for green manure. The trial ground was 5160 ft. above sea level. An account is given of the plants tested with special reference to the formation of root nodules and to the appearance of disease.

1263 – **The Solubility of Phosphoric Acid in Mineral, Basic and Calcined Phosphates, and in Basic Slag.** — AITA A., in *L'Italia Agricola*, Year LV, No. 10, pp. 446-453. Piacenza, October 15, 1916.

Since the middle of the nineteenth century phosphatic manures have been employed chiefly as superphosphate and basic slag. In recent years, however, attempts have been made to re-introduce the use of natural phosphates in one of the three following forms: 1) ground phosphate which consists of the raw mineral reduced to a very fine state of division ; 2) calcined phosphate or "thermophosphate" which is the mineral phosphate after simple calcination ; and 3) basic phosphate, a product obtained by calcining the raw mineral with basic or alkaline substances. The writer has studied the solubility of mineral phosphates, more especially the less soluble ones, (*Annali di Chimica applicata*, July and August 1916) and gives a summary of his work in the present paper.

*Mineral phosphates.* — Recent experiments have shown that :

1) The power of assimilating phosphoric acid from mineral phosphates varies with the species of the plant, being marked in crucifers and hardly perceptible in cereals.

2) A very fine state of division increases the availability of mineral phosphates.

3) With phosphates in general, and particularly with the less soluble phosphates, the manurial value is dependent on : *a*) the lime content of the soil ; *b*) the nature of the nitrogenous manure applied with the phosphate ; *c*) the magnesium content of the soil. These three factors are referred to as the *calcium, lime and magnesium factors.*

It has been maintained that the slow availability of phosphoric acid in mineral phosphates is reflected in a low solubility in 2 per cent citric acid solution ; but this hypothesis has since been disproved, it being shown that mineral phosphates yield the whole of their phosphoric acid to 2 per cent citric acid provided a sufficient amount of the solvent be used and the extraction be continued for a sufficient length of time. The writer subjected different types of phosphates (Tunisian, Algerian, Florida and Pacific)

to repeated extractions with 2 per cent citric acid, the samples being hand shaken for an hour at room temperature. It was found that the amount of phosphoric acid dissolved in the consecutive extractions varied not only according to the nature of the mineral and its lime content, but also according to its state of division :

1) Nodular and rock phosphates (Land Pebble, Medulla, Angaur) yielded their phosphoric acid less readily than the more friable minerals of a sedimentary origin, nodular phosphates requiring 7 extractions and rock phosphate 5 or 6 extractions for the complete removal of the phosphoric acid.

2) A Bir el Afou phosphate, ground to a degree of fineness which allowed 85 per cent of it to pass through a sieve with 100 meshes to the inch, yielded 29 per cent of its phosphoric acid in the first extraction and required 4 further extractions for the complete removal of the phosphoric acid, whereas an Egyptian phosphate of 58 per cent fineness only yielded 21.71 per cent of its total phosphoric acid to the first extraction, and for the complete removal of the phosphoric acid, 5 further extractions were necessary.

3) Calcium carbonate when present, neutralised the citric acid, thereby reducing its solvent power in proportion to the amount of carbonate present. In the first few extracts obtained from a calcareous sample, a Gouraya phosphate containing 21.22 per cent of calcium, the phosphoric acid increased whilst the carbonate decreased. On the other hand with Constantine, Gafsa and Bir-el-Afou phosphates containing only 13.27, 10.10 and 9.95 per cent of carbonate respectively the amounts of phosphoric acid found in the extracts followed a regular descending curve from the first to the last of the extractions.

In a second series of experiments a study was made of the influence of the other salts used as fertilizers (sulphates, nitrates and chlorides of ammonium, potassium, sodium and magnesium) on the solubility of phosphoric acid. Citric acid solutions were prepared containing increasing fractions of the equivalent weights of these salts and in each case 250 cc. of the solution was shaken up with 2.5 gms. of the raw phosphate for an hour. With the system ; tricalcic phosphate, phosphoric acid, calcium citrate and citric acid it was found that the solvent action of citric acid ceases on the establishment of equilibrium between the free phosphoric acid and the calcium citrate which is formed. The presence of a salt of a strong, acid, such as potassium sulphate, upsets this equilibrium by causing a double decomposition between the added salt and the calcium citrate ; potassium citrate is formed and acts further on the tricalcium phosphate until a new equilibrium is established, this time between the two salts with a common ion, potassium sulphate and potassium phosphate. Nitrates and chlorides of ammonium, potassium, sodium and magnesium behave in an analogous manner. On the other hand the presence of calcium salts (chloride and nitrate) inhibits the solvent effect. The general conclusion may be drawn that the solubility of phosphoric acid is increased by the addition of salts of strong acids giving rise to soluble phosphates, and is decreased by the

addition of salts of acids weaker than citric acid owing to the fact that in such cases (*e. g.* carbonates) the citric acid displaces any such acid radicle and loses part of its solvent power in the process.

Assuming that the reactions in the soil are analogous to those described above, the following practical conclusions may be drawn : 1) Fertilizers containing calcium salts lower the availability of phosphates ; 2) nitrogen and potash manures in the form of sulphates, nitrates and chlorides increase the availability of phosphates in the order given ; 3) magnesium sulphate, nitrate or chloride acts in a similar fashion.

*Calcined and basic phosphates.* — The writer states that the calcining process merely raises the cost of the product without rendering the phosphoric acid more soluble.

With regard to the production of basic phosphates, so far the only process working on an industrial scale is in Sweden where 20 000 tons of « Wiborgh » phosphate are turned out per annum. Ground apatite is heated with alkaline sulphate to a red or yellow heat and the product contains phosphoric acid which is soluble in 2 per cent citric acid. It has been thought that the tricalcic phosphate combines with the alkali at high temperatures to form a tetracalcium phosphate ($5CaO.\ 2No_2O.\ 4P_2O_5$ or $5CaO.\ 2K_2O.\ 4P_2O_5$) analogous with the one believed to exist in basic slag. The writer, however, does not accept the view that this compound exists either in Wiborgh phosphate or in basic slag, and believes that the increased quantity of soluble phosphoric acid in the former is due to the presence of alkaline sulphates.

*Basic slag.* — A series of experiments was undertaken to throw light on the question as to whether the solubility of the phosphoric acid in basic slag be due to some of the secondary products contained in the slag. The raw phosphates were treated with citric acid in the presence of: iron and aluminium filings, ferrous sulphate, ferric chloride, aluminium sulphate, manganese sulphate and hydrate and magnesium silicate. The following results were obtained :

1) Silicates exerted a retarding effect on the solubility of the phosphoric acid, silicic acid being weaker than citric acid. Manganates behaved in a similar manner.

2) Ferrous sulphate and manganese sulphate behaved exactly like ammonium sulphate, alkaline sulphates and magnesium sulphate, the solubility of the phosphoric acid increasing with the concentration of these salts.

3) The same is true in the case of ferric and aluminium salts the presence of a very small quantity of these salts being sufficient to increase markedly the solubility of the phosphoric acid. It is stated that the increased solubility here is due to the combined effect of two distinct causes: *a*) the retarding of the equilibrium by the slag, and *b*) the formation of a complex salt of iron or aluminium with citric or phosphoric acid. This complex salt undergoes little dissociation and causes a radical change in the equilibrium of the system : tricalcic phosphate, phosphoric acid, calcium citrate, citric acid and ferric or aluminium salts. The fact that similar results were

obtained whether iron or aluminium filings were employed confirmed the deduction that the citrophosphate group was intimately connected with the iron or aluminium.

It has been shown previously that all the secondary products contained in basic slag are dissolved by 2 per cent citric acid to an extent which varies with the nature of the slag. The writer found that by using a solution of saccharose to remove the lime the solubility of the phosphoric acid was increased, likewise that of all the other constituents. The secondary compounds of slag can therefore be classified into two groups: 1) those which hinder the solubility of phosphoric acid (lime, silica, silicates and manganese), and 2) those which assist it (sulphates, iron and aluminium). Amongst the latter group the sulphates may be neglected as they are only present in minute quantities but the presence of the two metals not only counterbalances the effects of the first group of substances, but actually exerts a definite solvent action on the phosphoric acid.

*Conclusions.* — Basic slag like the mineral phosphates contains phosphoric acid in the form of tricalcic phosphate. Their relatively high degree of solubility in citric acid as compared with mineral phosphates is attributed to the presence of iron and aluminium in the slag. The difference in the solubility of slags may be due to any or all of the following three causes : 1) a variation in content of iron and aluminium ; 2) the percentage of soluble phosphoric acid present ; 3) the presence of other bodies which exert a retarding effect on solution.

1264 – **Nitrate of Soda and Ammonium Sulphate on Sugar Cane in Java.** — GEERTS J. M., in *Mededeelingen van het Proefstation voor de Java-Suikerindustrie*, Vol. VI, No, 9, pp. 223-305. Soerabaja, 1916.

Experiments have been carried out in Java during the last few years to compare the manurial value of sodium nitrate and ammonium sulphate for sugar cane (1). These have shown that ammonium sulphate gives the best results on sandy soils and sodium nitrate on heavy land.

Where nitrate was used no deleterious action on the structure of the soil was observed, nor is there any likelihood of this occuring in Java as the nitrate is not applied every year and further the land is irrigated. Owing to its extreme solubility nitrate is specially adapted to regions of low rainfall and gave the best results when applied in two or three dressings. It did not retard the ripening of the crop.

In Java ammonium sulphate is the more suitable manure in the majority of cases, and, unless supplies fail or the price of nitrate falls, it will continue to be the more popular fertiliser.

1265 – **Manurial Trials in Java.** — DE JONG A. W. K., in *Mededeelingen van het Agricultur-Chemisch Laboratorium*, No. XII, pp. 1-27. Buiterzorg, 1916.

A report is given of manurial trials in Java during the year 1915. With *manioc*, sodium nitrate had an excellent effect especially when

(1) See *R.* June 1916, No. 647.

used in conjunction with superphosphate or basic slag. It proved superior to ammonium sulphate.

With *rice*, calcium cyanamide and ammonium sulphate were equally successful and both were superior to nitrate. Applications of molasses had no appreciable effect. A double superphosphate was tested against Angaur phosphate and it was shown that in order to obtain the same results the dressing of Angaur phosphate had to be three times as large as that of the double superphosphate. The land was treated with sulphuric acid to destroy the weeds, and no ill effects could be detected on the subsequent rice crop.

With citronella grass (*Andropogon Nardus*), vulcanphonolite (1) produced no effect. The best results were obtained with a complete manure consisting of ammonium sulphate, potassium sulphate and double superphosphate.

1266 - **The Flora of the Belgian Coast.** — MASSART J., (Brussels University) in *Annales de Géographie*, Year XXV, No. 137, pp. 321-327. Paris, September 15, 1916.

AGRICULTURAL BOTANY, CHEMISTRY, AND PHYSIOLOGY OF PLANTS

An account is given of the evolution of the flora on the Belgian coast with special reference to its origin. No endemic species has been evolved on the Belgian coast. Fossil plant remains are rarely found, but such as are found, *e. g.* the sea buckthorn (*Hippophae ramnoides*) would indicate that in the pleistocene period when the region was inhabited by reindeer, the land was occupied by a flora adapted to a colder zone, and that with the return of a more temperate climate both fauna and flora retreated northwards.

The majority of the members of the present flora must have originated by immigration. The writer classifies the species into two groups, a smaller one containing plants peculiar to the coast land and a much larger group made up of the more abundant species. The latter are found equally on the more inland tracts and for the most part originated from the Flemish sands. A few calcicole species such as *Helianthus vulgare* must have migrated from the more distant calcareous regions of the Meuse or the Pas de Calais. Finally the true marine plants whether distributed on the dunes or on alluvial land can only have come from other coastal regions. The study of the geographical distribution of 69 of these species in Europe revealed the fact that the majority of the species are characteristic of a warmer climate. In other words the migrations from the south have been far more frequent than those from the north.

1267 - **Nitrogen Fixation, Nitrification, Denitrification and the Production of Sulphuretted Hydrogen by Bacteria in the Arctic Ocean.** — ИСАЧЕНКО Б. Л. (ISSATCHENKO B. L.) in *Журналъ Опытной Агрономіи имени П. С. Коссовича* (Review of Agricultural Experiments dedicated to the memory of P. S. KOSSOVITCH), Vol. XVII, No. 2, pp. 175-179. Petrograd, 1916.

In 1906, a scientific and commercial expedition left the Murmanian coast (Province of Archangel) and travelled to the 73° lat. north on the coast of Novaya Sembya (an island bounding the sea of Kara on the west.) A

(1) The trade name given to a ground phosphate.

full report of the bacteriological work accomplished on this expedition has recently been published by the Russian Department of Agriculture (1) and the present paper merely summarises the report.

The bacteria in the Arctic Ocean were investigated in order to determine their influence, direct or indirect, on the organic life of the ocean. In 1890-1891, investigations of a similar nature were already being carried out by Russians in the Black Sea and the production of sulphuretted hydrogen was observed. But with regard to the northern waters, though there were grounds for believing that they contained an active bacterial flora, actual experimental data was very scarce. In 1899 some results were published stating that from 11 cc of water only one colony had been obtained. In 1907 investigations were begun in the waters of the South Pole, but these hardly dealt with the action of specific organisms. Nevertheless it was the results of these experiments together with the fact that denitrification does not usually take place at temperatures much below about 20° C. which gave rise to the theory known as Brandt's hypothesis, *i. e.* that the distribution of plankton in the ocean is controlled by the supply of combined nitrogen according to Liebeg's Law of the Minimum and that the combined nitrogen in its turn is dependent on the activity of the denitrifying organism; therefore that the relative abundance of plankton in the arctic seas compared with warmer waters is due to the absence of denitrifying bacteria.

In the Murman expedition *Clostridium* and *Azotobacter* were isolated from the mucilaginous surface of seaweed on which they live and from which they draw the necessary energy for growth and nitrogen fixation. Both organisms developed best in media containing sea salt. In sea water as in soil they were always accompanied by Winogradski's α and β bacilli. It would appear that a certain amount of symbiosis must occur between the nitrogen fixing organisms and the seaweed and that the organisms provide a very useful addition to the seaweed's food supply, given the natural deficiency of nitrogen in sea water.

Though nitrifying bacteria were found in the Gulf Stream at 72° lat. north near Iekaterininsk and in the Ugorskij Sharr, their presence in arctic seas is still unproved. It is pointed out that the low temperature, which might be looked upon as causing complete inhibition, while it slows down the process of nitrification, never entirely stops it even at 2° C.

Denitrifying bacteria were found fairly abundantly in the Arctic Ocean and they were studied in some detail. Even after four years. cultures of non spore-forming bacteria retained the power of decomposing nitrates and setting free nitrogen. Under perfectly anaerobic conditions

(1) Б. Л. Исаченко, Изслѣдованія надъ бактеріями Сѣвернаго Ледовитаго Океана. Съ 3 таблицами и 63 рисунками I—VII + 297 стр. (Труды Мурманской Научно-Промысловой Экспедиціи 1906 года. Изданіе Департамента Земледѣлія. Петроградъ. 1914). [Issatchenko B. L., Research on the bacteria of the glacial Arctic Ocean, 297 pp., in *Report of the Scientific and industrial expedition of Murman* (1906). Petrograd, 1914).

denitrification was suspended, but a very limited supply of oxygen (" microaerophily ") favoured the process. Low temperatures of 0° to 3° C. did not inhibit denitrification. As a result of his experiments, the writer concludes that denitrification is quite possible in the Arctic Ocean and that Brandt's hypothesis is not confirmed by the facts observed.

Finally, arctic waters were shown to contain two kinds of bacteria capable of producing sulphuretted hydrogen, one from sulphates (*Microspira aestuarii*) and the other from organic matter. It is pointed out that the formation of black mud on the coasts of Murman and Novaya Zembya and in Moghilnoie Lake in the Island of Kildine is due to the activity of these bacteria, more especially *M. aestuarii*.

1268 - **The Optimum Temperature of a Diastase is Independent of the Concentration of Substrate and Enzyme.** — COMPTON A., in *Annales de l'Institut Pasteur*, Vol. XXX, No. 9, pp. 496-502. Paris, September 1916.

In a previous investigation (1) it has been shown that the optimum temperature of a salicinase from sweet almonds is independent of the concentration of the substrate and of the enzyme itself, provided the duration of the enzyme action remain the same. In order to determine whether the statement would hold for enzymes in general, a similar series of experiments was carried out with the maltase of *Aspergillus Oryzae* or takadiastase. Kahlbaum's purified maltose was employed and the diastase solution was obtained by macerating 1 gm. of the diastase powder in 100 cc of pure water at room temperature. Then using solutions of hydrolised maltose of the following molecular concentrations: M/5, M/10, M/20, M/30, the activity of the enzyme was determined at temperatures varying from 17° to 56.4° C.

To measure the influence of the concentration of the diastase, solutions were prepared with 0.1, 0.3 and 0.6 gms. of diastase powder per 100cc of water as well as the standard solution given above. Again, in all four cases the optimum temperature was 47° C.

The writer is of opinion that with diastase fermentations the optimum temperature is always independent of the concentration of the substrate and of the enzyme. This fact is of practical importance as it means that the molecular concentration of the substrate solutions is not an important factor and need not be considered when substances such as glycogen, starch and proteins are used, whose molecular concentration is often unknown.

1269 - **On the Reduction of Nitrate by Plants with Evolution of Oxygen.** — MOLLIARD M., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 163, No. 15, pp. 371-373. Paris, October 9, 1916.

There are grounds for believing that nitrates are reduced in the leaves of plants and it has been suggested that there might be a resulting evolution of oxygen. An attempt was made to show that such an action

(1) ARTHUR COMPTON, in *Proceedings of the Royal Society*, B. 87, 1914, P. 245 ; *Annales de l'Institut Pasteur*, Vol. XXVIII, 1914, P. 866.

took place by comparing the gas formed by two plants, one of which was supplied with nitrogen in the shape of nitrate and the other with ammonium salts.

Radishes were grown in long necked flasks each of which was connected with a mercury manometer. The culture medium consisted (per flask) of 60 cc of fine broken pumice and 40 cc of nutrient solution containing nitrogen at the rate of 6.0 gm. of ammonium chloride or 1 gm. of potassium nitrate per litre. Throughout the experiment aseptic conditions were maintained. As soon as the seeds had been sown the neck of each flask was sealed, enclosing a volume of air which amounted to about 120 cc. Every day manometer readings were taken not only for the flasks containing plants but also for a control flask, so that corrections for pressure and temperature could be made.

After 35 days a plant receiving ammonium chloride had produced 0.994 gms. of green weight or 0.153 gms. of dry matter. The internal pressure of the flask fell for the first 9 days and then rose till it attained 2.11 cms. of mercury, which was equal to 2.77 cc of oxygen and brought the total amount of oxygen up to 22.5 per cent of the atmosphere in the flask. At the end of the experiment the respiration quotient was determined. A value of 1.02 was obtained.

Where the plant was supplied with nitrate, 0.264 gms. of dry matter were produced in 35 days and the internal pressure rose to 8.6 cms. of mercury. The oxygen in the flask was increased by 13.74cc, raising the percentage in the flask to 28.8. The respiration quotient was 1.07.

The fact that the flask containing nitrate increased its pressure more than the flask containing the ammonium salt led the writer to conclude that oxygen had been set free from the nitrate. Assuming that the increase in pressure for plants growing in the same medium is proportional to the dry matter produced, the excess of oxygen in the nitrate flask was determined, and it was found that for every atom of nitrogen fixed by the plant two atoms of oxygen had been set free.

1270 – **The Assimilation of Iron by Plants.** — Сидоринъ М. И. (Sidorine M. J.), *Московскій Сельско-хозяйственный Институтъ; Каѳедра Частнаго Земледѣлія. Изъ результатовъ вегетаціонныхъ и лабораторныхъ работъ. Годъ 19-й. Томъ X-й, подъ редакціей профессора* Д. Н. Прянишникова (Moscow Agricultural Institut, Prof. Prianichnikov's Laboratory, Results of plant cultures in 1914) Vol. X, pp. 241-257. Moscow, 1916.

The assimilation of iron by plants was studied in a series of water cultures and sand cultures carried out at the Agricultural Institute at Moscow. A first experiment with water cultures was undertaken to determine the influence of carbonates on iron assimilation; the following nutrient solutions were used:

*a*) Knop's normal culture solutions containing per litre:

| | |
|---|---|
| Calcium nitrate | 1 gm. |
| Potassium nitrate | 0.25 " |
| Potassium chloride | 0.25 " |
| Potassium sulphate | 0.25 " |
| Potassium phosphate | 0.25 " |
| Ferric phosphate | 0.20 " |

*b*) Knop's "acid" culture solution containing per litre:

| | |
|---|---|
| Calcium sulphate | 1.12 gm. |
| Ammonium sulphate | 0.45 " |
| Sodium nitrate | 0.42 " |
| Potassium phosphate | 0.27 " |
| Potassium chloride | 0.15 " |
| Magnesium sulphate | 0.12 " |
| Ferric phosphate | 6.20 " |

These were modified according to the scheme given below.

| | | | |
|---|---|---|---|
| 1) | Knop's normal culture solution | | |
| 2) | " " " " | without | iron. |
| 3) | " " " " | " | sulphur. |
| 4) | " " " " | " | magnesium. |
| 5) | " " " " | + 8 gms. | calcium carbonate. |
| 6) | " " " " | + 4 " | magnesium carbonate. |
| 7) | " " " " | + 2 " | sodium carbonate. |
| 8) | Knop's "acid" culture solution | | |
| 9) | " " " " | + 8 gms. | calcium carbonate. |
| 10) | " " " " | + 4 " | magnesium carbonate. |
| 11) | " " " " | + 2 " | sodium carbonate. |

In all cases where carbonates were present chlorotic plants were obtained, the effect of the three carbonates being identical. When a very little phosphoric acid was added, a green colour appeared at the base of the topmost leaves. The amount added was sufficient to give the nutrient medium an acid reaction, and in a later set of experiments the phosphoric acid was replaced by hydrochloric, sulphuric and nitric acids with the same result, showing that the antichlorotic action was due to the acidity of the solution and not to the presence of phosphorus. The exclusion of magnesium had no appreciable effect on chlorosis, but the plants without sulphur were affected though not quite in the manner described by MAZÉ. According to the latter, chlorosis caused by the absence of sulphur is identical with chlorosis caused by the absence of iron, whereas in the present experiments, sulphur chlorosis was somewhat later in appearing and the colour of the leaves was never quite the same in the two cases.

For the sand cultures the same scheme was adopted as for the water cultures but Hellriegel's nutrient solution was substituted for Knop's. Pots with a capacity of 4 ½ litres were used. The results obtained were somewhat different from those of the water cultures and this was attributed to the nature of the medium which was never quite neutral.

The phenomenon of chlorosis was then studied in greater detail by the method of "isolated nutrition" or in other words by dividing the root system into two parts, one of which received the iron alone, or iron and carbonate alone, and the other the rest of the food solution. Where a carbonate was added, chlorosis appeared as before, but where iron was used alone, variegated leaves were obtained. In the majority of cases one half of each leaf was yellow and the other half green, but sometimes there was a green band in the middle with yellow on either side, or the leaf might

even have a yellow ground with green ribs. This last phenomenon was observed for the first time 8 or 9 days after the experiment had begun on the third, fourth and fifth leaves. Small drops of ferric chloride placed on the yellow parts of the leaves immediately caused green spots to appear. As the plant got older the coloration changed. The sixth leaf always had green ribs and the seventh was wholly green; the variegations of the fifth tended to become less sharply defined, but the third and fourth leaves remained unchanged.

When a few drops of phosphoric acid were added to the cultures containing carbonates, a faint greenish colour appeared at the base of the leaves after 3 or 4 days; and plants grown in pots with calcium carbonate were injected with 0.25 cc of ferric chloride solution (0.03 per cent) which produced a green coloration in the parts above the point of injection. In all the experiments on variegation, not only maize was used but also sorghum, barley, buckwheat and beans; the last two plants, however, did not behave in the same manner as the other three.

A last set of experiments was carried out with the nutrient solutions of Hellriegel, Prianichnikov and Crone in order to test Benecke's theory of chlorosis which was fully confirmed.

*Conclusions.* — When plants are grown in culture solutions containning free carbonates, the chlorosis produced is due to the alkalinity of the carbonates, more especially of calcium carbonate. This alkalinity is not however a direct cause of chlorosis, but acts indirectly by making the iron inaccessible to the plant. Such effects may also occur under natural conditions if the food solution be physiologically alkaline.

The property possessed by iron of forming almost insoluble salts with phosphorus prevents iron assimilation from taking place in nutrient solutions.

Chlorosis may be caused by absence of sulphur as well as by absence of iron.

There are often essential difference between the results obtained in sand and in water cultures.

Iron is particularly interesting in its strictly localized assimilation by plant tissues, as shown by the experiments on " isolated nutrition ". This should prove a means of obtaining valuable material for the study of problems connected with the internal structure of plants.

1271 – **Influence of Calcium and Magnesium Compounds on Plant Growth.** — WYATT F. A., in *Journal of Agricultural Research*, Vol. VI, No. 16, pp. 589-619. Washington, D. C., July 17, 1916.

Experiments were planned with the idea of studying the effects of calcium and magnesium upon plant growth when applied in different natural and artificial forms. Studies were made to determine the amount of calcium and magnesium which plants could tolerate. The relation between the ratio of these two elements in the plants, in the soils, and in the materials supplied was also studied.

Dolomite, limestone, magnesite, calcareous soils, and brown silt loam were used as sources of the natural forms, while prepared materials, such

as the carbonates, chlorides, and sulphates, served as sources of the artificial forms. Increasing amounts of the various forms were used, also a variance in the ratio of calcium to magnesium was employed. The earlier applications varied from 0.1 to 0.6 per cent of magnesium added in magnesium carbonate and in magnesite. Later the following amounts were employed: 2,6, and 10 per cent of magnesium in magnesite; 10 and 12.7 per cent in dolomite; 0.1,0.01, and 0.001 per cent of magnesium in the carbonates, chlorides, and sulphates.

Earthen pots 6.5 ins, in diameter by 7.5 ins. in depth were used. Each pot contained 13.2 lbs. of sand, while in the soil series each contained 8.8 lbs. of brown silt loam. Sand and soil were used as mediums of control, and to these two materials were added the various forms and amounts of calcium and magnesium.

Various methods were pursued in extracting the sand. At first dilute hydrochloric acid was kept in contact with the sand for 48 hours, but this failed to remove all the calcium and magnesium. Later the sand was extracted with stronger acid (1350 cc of concentrated hydrochloric acid with 1000 cc of distilled water) for periods of from 9 to 14 days. Sand was also digested on a steam bath for 4 days with this same strength acid. None of the above processes were able to remove all the calcium and magnesium from the sand. After treatment it still contained:

| | Calcium | Magnesium |
|---|---|---|
| | — | — |
| Extraction with dilute acid for 2 days | 0.0142 per cent | 0.016 per cent |
| " " strong " " 4 " | 0.0128 " " | 0.0089 " " |

At intervals varying from 10 to 14 days, nutrient solutions were added to the pots and every 10 days the pots were brought to standard weight by watering with distilled water. The experiments were run in greenhouses and the principal crops used were: wheat (*Triticum* spp.), alfalfa (*Medicago sativa*), soybeans (*Soja max*) and cowpeas (*Vigna sinensis*). Oats (*Avena sativa*), clover (*Trifolium pratense*), timothy (*Phleum pratense*), and sweet clover (*Melilotus alba*) were also used to test the effect of artificial carbonates upon germination.

The experiments reported here extended over a period of three years (1912 to 1915) and include approximately 300 pot cultures and upwards of 300 duplicate determinations of calcium and magnesium.

Difficulty was experienced in finding a medium that was free from calcium and magnesium, and which would still approach soil conditions. Attempts were made to grow plants in aluminium turnings but without success, probably due to the formation of some aluminium salts when the plant foods were added.

Wheat and cowpeas grown in granular paraffin without the addition of calcium and magnesium showed in the total plant only an amount equal to that furnished by the seed.

The difference in the medium in which the plants were grown caused different effects upon the plants. Brown silt loam was a better medium than sand when treated with chemically pure magnesium carbonate, even

though it already contained 25 times as much calcium and magnesium as did the sand. Still sand would have an ameliorating effect when compared with water cultures. JENSEN found that in quartz sand a much higher concentration of salts was required to cause death than in water cultures.

It is quite generally believed that plants have to some extent a selective absorption. The results here seem to indicate such a condition, for the dolomites used tend to go into solution in a molecular ratio, but the plants failed to take them up in this ratio. The tendency of the plants under these conditions was to take up relatively larger molecular proportions of magnesium than of calcium. Analysis of the plants show that they do not necessarily take up calcium and magnesium in the same ratio as applied, as, for example, in dolomite C3 the ratio of calcium to magnesium is 5 : 5.2, while the plants may and do take it up in a ratio of 5 : 7 or 5 : 3.95.

In the case of the addition of 25 per cent of magnesite the ratio of calcium to magnesium was 5 : 125, while in some of the plants grown in such treatment the ratio varied from 5: 15 to 5: 21. Wheat grown in soil treated with 6 per cent of dolomite showed in the tops a ratio of 5 : 9.1 and in the roots a ratio of 5 : 4.35, or for the whole plant a ratio of 5 : 6.3, while in dolomite C1 it was 5 : 4.8. Alfalfa grown in the same treatment showed for the entire plant a ratio of 5 : 4.2, but when grown in soil treated with dolomite C3 the ratio for the total alfalfa plant was 5 : 3.95.

The chlorides of calcium and magnesium were more detrimental to wheat and soybeans than were the sulphates at concentration up to 0.1 per cent of magnesium. This amount of magnesium in the prepared carbonate entirely inhibited growth whereas lower concentrations gave better growth than either in the sulphates or chlorides.

Wheat 65 days old showed smaller percentages of calcium and magnesium than did similarly treated wheat at 53 days of growth, but the total amount of these two elements in the plants increased with the duration of growth.

Soybeans at maturity, or 80 days after planting, showed for the hay higher calcium and magnesium contents than at 53 days of growth, except in the case of the checks and those treated with extremely small quantities. Some of the samples showed as much as 73 lbs. of calcium and 25.2 lbs. of magnesium per ton when grown in a mixture of one-half sand and one-half calcareous soil, but when grown in soil containing 35 per cent of magnesite there were 22.9 lbs. of calcium and 42.3 lbs. of magnesium, per ton ; whereas the checks contained 5.8 lbs. of calcium and 5.6 lbs. of magnesium.

Wherever excessive amounts of magnesium were applied, there was a characteristic appearance of yellow leaves. The uppermost leaves became yellow and gradually died, while the lower leaves remained green. This condition is characteristic of magnesium sickness and just the reverse of the effects produced by translocation processes.

The general tendency is for the percentages of calcium and magnesium in the plants to increase with theincrease of size in application. Likewise a high magnesium content in the plant tends to accompany plant sickness,

as sickly and healthy leaves from the same soybean plant, showed respectively, 1.11 per cent of magnesium as against 0.88 per cent magnesium.

All varieties of the seed used contained more magnesium than calcium, while ordinarily the remainder of the plant contained more calcium than magnesium.

Nitrogen was applied to the legumes as well as to the cereals, so as to be sure that this was not the limiting factor.

*Conclusions.* — 1) Wheat, soybeans, alfalfa, and cowpeas grew normally either in 96 per cent of dolomite and 4 per cent sand, 100 per cent of magnesian limestone, or in sand containing 7 per cent of magnesite.

2) Dolomite up to 40 per cent proved beneficial to plant growth. These results indicate that dolomite and magnesian limestone will not be detrimental as applied in agricultural practice.

3) Applications of prepared magnesian carbonate up to 0.7 per cent caused no injury in brown silt loam, but 0.35 per cent prevented the growth of all plants tested in sand.

4) The crop yields and the ratio of calcium to magnesium within rather wide limits produced no marked differences in yields.

5) Different ratios of calcium to magnesium within rather wide limits produced no marked differences in yields.

6) Increasing the size of applications increased the calcium and magnesium content of plants.

7) A tolerance of calcium and magnesium occurred in all varieties of plants grown. With approximately identical yields, wheat straw grown in sand, brown silt loam, dolomite, and soil containing 35 per cent of magnesite showed calcium contents varying between 0.165 per cent and 0.547 per cent and magnesium contents varying between 0.132 per cent and 0.955 per cent.

8) Acid extractions failed to remove all the calcium and magnesium from the sand. There remained after the various extractions from 768 to 852 mgms. of calcium and from 540 to 960 mgms. of magnesium per 6000 gms. of sand.

9) The plants possessed a decided ability to obtain calcium and magnesium from sand extracted with strong hydrochloric acid, as borne out by the following example : Three crops of alfalfa removed from acid extracted sand 164.43 mgms. more calcium, and 90.4 mgms. more magnesium than was contained in seeds similar to those planted.

1272 – **Etiolated Cereal Plants.** — KALT B., in *Zeitschrift für Pflanzenzüchtung*, Vol. 4. No. 2. pp. 143-150. Berlin, June 1916. PLANT BREEDING

Many references have been recently made to the appearance of etiolated plants and the present paper describes some investigations made in 1915 at the Agricultural Institute of Halle University, Germany.

1. *Barley.* — A plant of a pure line of Groninger Wintergerste was crossed in 1915 with pollen from a pedigree plant of original Eckendorfer Mammut-Wintergerste. The $F_1$ generation gave about 30 perfectly normal plants from which 26 were chosen for propagation The descendants of 25 of these plants were quite normal in appearance, but from the last one (Elite $^1/_{14}$)

some white plants were raised in addition to the normal green ones. Ninety out of 100 seeds of Elite $^1/_{14}$ germinated; of these 75 plants were normally green and 15 (representing 16.6 per cent) were pure white without a trace of green colour. These white plants developed normally as long as the reserve food materials in the seeds lasted; they formed two leaves of normal size and thickness, but after 3 or 4 weeks they died because assimilation could not be carried on. Of the 75 green descendants of Elite $^1/_{14}$, 47 were eaten by insects during the year, 28 plants were harvested and 6 of these were selected for further investigation. All the seeds from these 6 plants were sown separately in autumn 1915. The other 22 plants were harvested and sown together.

The descendants of two of the 6 plants which were sown separately were normal and green, those from the other 4 being mixed. From the batch of 22 plants 10 960 seeds were sown and 9 646 plants were obtained, of which 8 412 were normally green and 1 234 were white. Theoretically these figures may be explained thus.

$C$ = presence of chlorophyll (dominant)
$c$ = absence of chlorophyll.

| | | | | |
|---|---|---|---|---|
| Generation $P_1$: | $C$ | | $c$ | |
| Generation $F_1$: | | $Cc$ | | |
| Generation $F_2$: | $CC$ | $Cc$ | $Cc$ | $cc$ |

If the 22 plants had all been equally prolific each plant would have produced 438 descendants, so that in $F_2$

| | | |
|---|---|---|
| $CC$ | $Cc$ $Cc$ | $cc$ |
| 3 215 | 6 430 | 0 |

The 3 215 $CC$ are constant in the $F_3$ generation; the 6 430 $Cc$, on the other hand, subdivide thus:

| | | |
|---|---|---|
| $CC$ | $Cc$ | $cc$ |
| 1 607 | 3 214 | 1 607 |

Thus there would be

| | |
|---|---|
| 3 215 | homozygotes of $F_2$ |
| 1 607 | homozygotes of $F_3$ |
| 3 214 | heterozygotes of $F_3$ |
| Total 8 036 | green plants. |

The theoretical calculation gives 8 036 green and 1 607 white plants in the $F_3$ generation, whereas actually 8 412 green and 1 234 white plants were obtained. This difference may be explained by the fact that an average number of grains was reckoned for each plant and also that only 22 plants, with a large number of tillers, were dealt with. The proportions between the numbers of green and white descendants of the six plants sown separately show quite clearly that etiolation is transmitted as a recessive character according to Mendel's law, thus confirming the results of NILSSON-EHLE, VESTERGAARD and MILES.

It is interesting to notice that in this case, in which the crossing was carried out in exact accordance with scientific rules, the characters were trans-

mitted in the same way as in a crossing between green plants and white plants in which green is dominant. Thus when abnormal hereditary characters have appeared it has been possible to trace back the combination of factors *Cc* as far as their association at the time of hybridisation, and even to examine pure lines to seek for the eventual presence of the factor *c*. In this investigation more than one half of the available seeds of two pure parent lines were sown (1 000 grains in each case) and it appeared that the factor *c* did not occur in these lines, because all the plants raised were normally green, whereas the heterozygotes *Cc* shoul have produced white descendants as well after self-fertilization. If one admits, with NILSSON-EHLE, that the cause of the appearance of white plants is a mutation in which a determinant chlorophyll factor has disappeared, this mutation, called a " mutation of loss ", must have occurred at the time of hybridisation ; for, on the one hand, the parents were pure, and on the other hand, the first appearance of the white plants in the generation $F_2$ and their definite mendelism proves that the first association of *C* with *c* occurred in the generation P, *i. e.* in the hybridisation itself.

As was shown at the beginning the crossing gave about 30 plants, of which 26 were used for continuing the investigation. These all had the same plant as mother and also the same male parent, as the pollen used for fertilization was all taken from a single plant. Only one of these 26 plants had any white descendants. The inevitable conclusion is that the supposed mutation had not affected the whole of the male or female parent, but only some of the gametes, possibly even one gamete only. It is obvious that of the 52 gametes (26 male, 26 female) which entered into combination in this cross only one, either male or female, posessed the factor *c*, a predisposition to the absence of chlorophyll.

As in this case the factor *c* appeared at the time of crossing the idea naturally suggests itself that the fact of crossing played a part in the formation of white descendants, and perhaps even caused the mutation. This hypothesis is favoured by the fact that up to the present white individuals have been chiefly noticed among cross pollinated plants. During the researches on etiolated plants the author of this paper has found about 1 000 white descendants in rye, 1 in 6-rowed barley, one in 2-rowed bent-eared barley, 1 in oats, none in erect-eared barley and in wheat.

With a view to solving these problems it is intended, during the next few years, to grow both singly and in mass the pure lines from which the white plants were descended.

II. *Rye.* — In the autumn of 1915, 44 out of 104 lines (nearly 50 per cent) of Saaleroggen (rye from the Halle district on Saale) divided up into green plants and white plants. Nevertheless, in each line the proportion of white plants never exceeded 10 per cent and on the average did not even reach 5 per cent. The reason of this was that in rye after the crossing $C \times c$ in the generation $F_1$ no self fertilization occurs such as is necessary to produce the mendelian numbers, but, on the contrary, the heterozygous ovules *Cc* are fertilised by foreign homozygous (*CC*) or heterozygous (*Cc*) pollen ; it is only in the latter case that white plants can appear in the $F_2$

generation. If all the ovules were fertilized by heterozygous pollen 25 per cent of white individuals could be produced. As this probability is excluded this 25 per cent represents the maximum theoretical limit of probability, and the actual number of white descendants appearing in the $F_2$ generation of a single crossing is determined only by the frequency with which plants predisposed to lack of chlorophyll occur in the neighbourhood. This explains why the number of white plants appearing in a single line or rye is relatively so small, although such plants occur in a large number of lines.

It is evident that the appearance of white plants is of extraordinary frequency in the rye under discussion. On the other hand such plants were rarely seen in 30 other kinds of rye grown at the Experimental Station. Saaleroggen is a local variety peculiar to the environs of Halle and it hs been grown for a long time without the introduction of fresh blood. As it has been grown by in-breeding there is every reason to believe that this method of cultivation is the cause of the lack of chlorophyll. This hypothesis is rendered more probable by the fact that the appearance of white plants seems to increase steadily in spite of the dominance of the factor " presence of chlorophyll ".

As in the observations made by NILSSON-EHLE, the heterozygous plants of barley and rye which are the parents or even the sister-plants of the albinos in the Halle district are in no way different from the normal homozygous plants of the variety. The green chlorophyll is strongly dominant, but this dominance seems only to occur in indigenous cereals, as EMERSON has found in Maize some heterozygous plants of an intermediate type striped with green and white.

1273 – **Two New Seedling Hops of Commercial Promise.** — SALMON E. S., in *Journal of the Board of Agriculture*, Vol. XXIII, No. I, pp. 47-51. London, April 1916.

In 1906 the writer commenced to raise new varieties of hops from seed obtained by artificial and by natural cross-fertilisation, and at the present time the Experimental Hop-garden at Wye College contains nearly 4 000 " hills " of seeding female hops and selected male hops. The commercial value of the most promising of the seedlings is now being tested.

In a preceding article (*Journal of the Board of Agriculture*, May 1915) attention was drawn to a new hop, the Foundling, which is resistant to the eelworm disease and shows other characters of commercial importance; in the present paper two other seedlings are described which appear worthy of more extended trial by the hop-growers of this country.

The first of these new varieties was raised in 1906 by pollinating the variety White's Early with Early Bird. All the plants thus obtained showed a resemblance to White's Early in earliness, in the large, bold, rather open hops with thin petals, and in possessing the delicate " Golding " flavour. Two or three of the seedlings show promise commercially, but only one (No. 125), called Young Hopeful, has yet been tested sufficiently. The dry hops for several seasons have been favourably reported on by various experts. In 1910 and 1911 the hops contained 8.66 per cent of soft resins; in 1912 the percentage was 10.30. During the last three years cuts of this plant have

been sent to twelve localities in Kent and Surrey, and where the hop has become established favourable reports as to the growth have been received.

The second good hop, called Pickers Delight, is of unknown parentage; it was raised in 1908 from a seed collected in the Experimental Hop-garden at Wye College from a certain hop which showed the following characters: — Early to mid-season, growth very vigorous, very fruitful, hop very large, oval, nice shape, dense, often with a tinge of red on the petals, flavour pronounced good in most cases, sometimes excellent. The seedling hop is now being grown experimentally in 12 places in Kent and in 2 localities in Surrey and Sussex.

1274 – **The Value of Immature Potato Tubers as Seed.** — HUTCHINSON H. P., in *Journal of the Board of Agriculture*, Vol. XXIII, No. 6, pp. 529-539. London, September, 1916. STARCH CROPS

Many practical potato growers believe that tubers lifted in an immature or unripe condition give better yields than fully ripened tubers. This has been confirmed by experiments carried out at Garforth (Yorkshire) in 1905 and 1906 with mid and late-season varieties, at Wye College (Kent) in 1912 and 1913, and at the Midland Agricultural College in 1914 and 1915.

At the Midland Agricultural College in 1914 the variety Factor yielded as follows:

| | tons | cwt | lbs |
|---|---|---|---|
| Crop raised from ripe tubers. . . . . | 12 | 4 | 72 |
| Crop raised from immature tubers . . . | 13 | 9 | 80 |

In 1915 the variety King Edward yielded:

| | | | |
|---|---|---|---|
| Crop raised from ripe tubers. . . . . | 6 | 4 | 62 |
| Crop raised from immature tubers . . . | 12 | 19 | 42 |

The use of immature tubers as seed gives plants that are earlier, more vigorous, and less attacked by diseases and pests, while the crops are earlier and heavier.

The superiority of immature seed may be due to the following causes:

1) *Method of selection.* — In usual farming practice the tubers retained for planting purposes are of medium and smaller sizes, the larger tubers being sold. For planting with immature seed the larger tubers are selected, which are mainly derived from the most productive plants, so that the resulting tendency is to increase, or at least to maintain, previous productivity.

1) *The structure of the tuber coats.* — The cortex of immature tubers is thinner, which facilitates evaporation, imbibition, respiration etc and consequently aids germination.

3) *The amount and condition of the reserve food material.*

4) *The length and time of storage.* — The immature tubers are given several weeks longer storage, so that a larger proportion of the starch is transformed into compounds that are more easily assimilated by the young plant.

1275 – **Potato Trials in Guernsey.** — McFie J. B., in *The Gardener's Chronicle*, Vol. LX, No. 1555, pp. 180-181; London, October 14, 1916.

During the autumn of 1915 potato trials of some of the leading early varieties were carried out in Guernesy at the Brookdale Nurseries of Messrs. W. Manger and Sons, with the purpose of ascertaining which were the more suitable for their district taking into account the cropping and cooking qualities. Land to the extent of one acre, on which bulbs had been grown for about ten years was set apart for the purpose and prepared as follows: Seaweed at the rate of 30 tons per acre was spread on the surface and allowed to lie for a month or so, after which it was dug in about 5 inches deep. That was in the fall of 1915. In January of this year the ground received a further dressing, but this time of stable manure at the rate of 20 tons per acre. This was ploughed in about 9 inches deep. At the end of February and early in March the trials were planted beginning with the first earlies. Two feet were allowed between the drills and about 16 inches between the sets. A liberal dressing of Peruvian guano was sown in the drills during the planting (½ ton to the acre), and as soon as the tops were clearly visible they were forked between and earthed up a fortnight later. At the end of May, when the plants were growing strongly, they were sprayed with Bordeaux mixture, and again after a fortnight. The result was that practically no blight (*Phytophthora infestans*) was seen on the early varieties. During the early part of July, the disease was noticed in the second early and main crop varieties. Fortunately, however, this only affected the haulm, as at digging time hardly 1 per cent of the tubers were affected, a result which is no doubt entirely due to the spraying with Bordeaux mixture.

The following are the average crops, per acre, obtained:

| | | Tons | Cwts |
|---|---|---|---|
| First Earlies: | Midlothian Early | 12 | 10 |
| | Sharpe's Express | 12 | 8 |
| | Witch Hill | 10 | 18 |
| | Dunottar Castle | 10 | 14 |
| Second Earlies: | Great Scot | 24 | 18 |
| | Edinburgh Castle | 19 | 12 |
| | Dobbie's Favourite | 19 | 12 |
| | Stirling Castle | 15 | 10 |
| | Arran Chief | 16 | 19 |
| | Suttons Flourball | 14 | 17 |
| | White City | 10 | 8 |

1276 – **Experiments on the Manuring of Potatoes in Germany.** — Weber P. and Kleberger, in *Journal für Landwirtschaft*, Vol. 64, Part 3, pp. 181-199. Berlin, October 19, 1916.

Experiments have been made to determine how the yields of potatoes and starch are affected on sandy soils, loams and clays, when a manure containing phosphate and potash is supplemented by one or other of the following nitrogenous fertilisers: ammonium sulphate, calcium cyanamide, ammonium nitrate, purin.

In each experiment the manure applied per acre consisted of 3 ½ cwt. basic slag and 1 ½ cwt. potash salts (40 per cent), together with the nitro-

genous manure, either 1 ½ cwt. ammonium sulphate, 1 ½ cwt. cyanamide, ¾ cwt. ammonium nitrate or 281.6 gallons purin. The question of the effect of the nitrogen in purin and the commercial manures was approached after the nitrogen, potash and phosphate requirements of the soils had been determined. All the manures, except ammonium nitrate, were spread about a fortnight before seeding. The purin, which contained 3 to 4 parts per thousand of nitrogen, was distributed on two occasions, a fortnight and a week before planting. Half of the ammonium nitrate was applied as a top dressing, when the young plants appeared, and the other half about a fortnight later.

The soils used for the experiments were:

1) a very light sandy loam derived from the disintegration of banded sandstone, deficient in chalk and potash.

2) a stony diluvial soil, rather impervious, deficient in chalk and potash.

3) two siliceous loams of tertiary age containing plenty of chalk and a sufficiency of potash.

4) two clay soils derived from disintegrated basalt, containing a fair amount of chalk and plenty of potash.

The farms on which the experiments were carried out are worked under the system of intensive cultivation.

The land was prepared about the middle of April, the manures were applied at the end of the month and Industry potatoes were planted in rows between May 7 and 11. The development of the crops was normal, but those on the sandy land suffered from drought in the summer of 1915.

The results of the experiments were set out in tables from which the following conclusions have been drawn, showing the great importance of the use of manure:

1) Nitrogen is usually the factor which determines the yield of potatoes, particularly on good clay soils, but on sandy soils mineral manures (potash, phosphate) seem to be more important in this respect.

2) A maximum yield cannot be obtained on strong land without potash and phosphate manuring, even with heavy applications of nitrogen.

3) Of the nitrogenous manures tested ammonium sulphate always gave the best results on all types of soil, though cyanamide and ammonium nitrate were not far behind.

4) Purin gave such satisfactory results that it can be strongly recommended as a manure for potatoes.

5) The highest starch yields were obtained with potash and phosphates without the addition of nitrogen. Purin only caused a small reduction in the proportion of starch, while the other nitrogenous manures brought about a much greater decrease. The potato seemed to be very sensitive to the use of cyanamide and ammonium nitrate, as these manures encouraged rotting. Potash manuring always caused an increase in the proportion of starch.

6) The quantity of nitrogen applied in the manure is not always reflected by the crop yield. For example, ammonium sulphate, of which

only the 90 per cent was used on clay land, gave better results than ammonium nitrate was not completely assimilated by the plant or that it was utilised for stem and leaf production to a greater extent than the ammonium sulphate.

7) The experiments show that the nature of the nitrogenous manure has a very great influence upon the utilisation of potash and phosphoric acid. These two substances are used to the greatest advantage in the presence of ammonium sulphate, ammonium nitrate and cyanamide, in the order named.

8) Purin is very satisfactory, especially on clay soils, so that it deserves special attention on this account.

FORAGE CROPS, MEADOWS AND PASTURES

1277 – **Pasture Problems: Indigenous Plants in Relation to Habitat and Sown Species.** — STAPLEDON R. G. and JENKIN T. J., in *Journal of Agricultural Science*, Vol. VIII, Part I, pp. 26-64. Cambridge, September 1916.

The aims of the present paper are *a*) to trace the relationship that exists between the several indigenous plants that contribute to the herbage of different types of grassland;

*b*) to follow the progressive changes that occur on fields (down to grass for a varying number of years,) belonging to these types;

*c*) to follow the competitive interaction between sown and indigenous species;

*d*) to contrast the effect on the herbage of continual mowing and continual grazing.

Most of the data presented are derived from investigations in South and Mid Wales, but occasional examples are given from North Wales and the Cotswolds.

A distinction is drawn between natural and semi-natural types of grassland. Natural types are those which historical evidence suggests have never been extensively under the plough or manured and which, if broken or manured at a remote period, have completely reverted to type. Semi-natural types are those which have certainly, at one time or another been under the plough and, at all events, manured during the rotation previous to reverting to grass. The semi-natural types may be further classified as *untended*, those which have been ploughed and probably manured 50 to 100 years ago, and *tended*, those which have been down to grass for 20 to 50 years.

Grassland plants may be divided into the following classes, which are applicable to all districts and to all types of grassland.

*a*) Primary indigenous species, which colonise natural grassland.

*b*) Secondary indigenous species, which come in without having been sown and which contribute largely to the herbage on semi-natural types of grassland.

*c*) Tertiary indigenous species, which come in by themselves on young leys but which disappear as the fields approach the semi-natural type.

*d*) Locally exotic species, which are indigenous to a district but

which do not naturally contribute to the flora of a well marked type of grassland.

*e*) Exotic species, which are not indigenous in a district.

The number of primary species on most types of grassland is not considerable. When a field long under arable cultivation is put down to grass the primary species are usually late to come in ; this is particularly true of *Bromus erectus, Molinia caerulea, Nardus stricta, Triodia decumbens* and *Festuca ovina* ; and if they come in early, they do not rapidly make their contribution to the herbage, *i.e.* they may fall below their minimum or exceed their maximum figures. Primary species which sometimes come in early are frequently met with as arable weeds, such as *Poa trivialis* and *Festuca rubra* at lower elevations and on the better soils, and *Agrostis vulgaris* on the poorer soils.

The various stages in the process of stabilisation of semi-natural grassland — through tended to untended and thence into natural types — may be summarised thus :

At 20-30 years, under the influence of periodic manuring and comparatively heavy grazing with cattle and sheep the secondary species (*Cynosurus cristatus, Trifolium repens, Plantago lanceolata* etc) are still abundantly represented ; the primary species (*Agrostis vulgaris, Festuca ovina* and the heath herbs) are, however, beginning to take a prominent place in the herbage.

At 50-100 years the primary species have gained considerably but do not yet stand in their normal relation to each other ; the secondary species are much reduced.

After 100 years the influence of the original disturbance and of manuring is now finally lost ; the grazing is generally by sheep only, the nett result being that the primary species have completely suppressed the secondary species.

The relation of primary and secondary species to their commercial and sown counterparts is as follows :

*a*) The commercial seed does not appreciably hasten the appearance nor add to the contribution of the desired plant. This is true of sowing *Festuca ovina* or other fine leaved fescues and is, in many cases, equally true of *Anthoxanthum odoratum* ; the inclusion of such seeds in mixtures is not justified economically. It is far from certain that the commercial *Trifolium repens* seed produces a lasting plant, as on many soils phosphatic manure is all that is necessary to hasten the appearance of the indigenous plant.

*b*) The commercial seed may produce a great bulk of the required plant in the early years of a ley (far more than the indigenous species would attain to naturally at any time). The behaviour of *Lolium perenne* sown on good soils is an excellent example. Under these circumstances good seedings of the commercial seed is economically justified, especially if hay is required in the early years of the ley.

*c*) The commercial seed may hasten the appearance of the desired plant and cause it to bulk somewhat more largely in the early years of a

ley than it otherwise would, but there is always some risk of the sown plant interfering with the development of the definitely lasting indigenous species. Good examples are *Poa trivialis* and *Cynosurus cristatus*; a knowledge of general conditions would often suggest excluding the former from a mixture, while the amount of seed of either that might be advantageously used needs further local investigation.

The desirability or otherwise of sowing the commercial seed of locally exotic species, or of but slightly secondary species, is easily determined. The commercial seeds lead to good results or they do not. If the commercial seed produces plants that are found to succeed it is however nearly always necessary to sow liberally; this is particularly true of *Dactylis glomerata*, *Festuca elatior*, *Cichorium Intybus*, *Phleum pratense* and *Arrhenatherum avenaceum*.

It is difficult to account for the spontaneous appearance of primary and secondary species (and of some locally exotic species, as *Holcus lanatus*, *Bromus mollis* et spp. and *Phleum pratense*,) on land long under the rotation when put down to grass, especially when more or less isolated from natural or semi-natural grasslands. The available evidence, however, suggests that:

*a*) Many species remain on the land as arable weeds on the soils that suit them, as *Poa trivialis*, *Agrostis vulgaris*, *Festuca rubra* and *Ranunculus repens*.

*b*) The seeds of many species are probably introduced by the wind, as *Holcus lanatus*, *Anthoxanthum odoratum*.

*c*) The seeds of many species are certainly introduced as impurities (useful and otherwise) in the sown seeds, as for example *Phleum pratense* (in *Trifolium hybridum*), *Plantago lanceolata* (in *Trifolium* spp.) *Holcus lanatus*, and *Bromus mollis* et spp. (in *Lolium* spp.)

*d*) There seems little doubt that the seeds of a great number of species are capable of lying dormant for long periods in the soil; in particular this may be true of *Trifolium repens* and *T. minus*, *Cynosurus cristatus*, *Poa* spp, *Phleum pratense* and *Festuca ovina*.

The data brought forward in this paper would seem further to justify the following broad generalisations with regard to both experimental work on grassland and the whole problem and economics of putting land down to grass.

1) Experimental plots dealing with seed mixtures should be large (at least half an acre) and square in order to give a considerable central zone. The hay should be cut as early as possible to avoid seeding and the carriage of seed from plot to plot. No series of plots can, henceforward, be regarded as complete without a control plot, which control should not be seeded (with grasses and clovers) but left to the indigenous species to colonise. The control plot should, of course, be subjected to the same cultivations, receive the same manures, and grow the same nurse as the seeded plots.

2) Undoubtedly when putting land down to long duration grass as much or more can be done by making the habitat as suitable as possible

to the desirable indigenous species as by including their commercial counterparts in the mixture. The commercial permanent grasses are far more valuable for say 4-6 year leys than they are for permanent grass as such.

*Poa* spp. and *Cynosurus cristatus* to some extent tide a field over its critical third and fourth years in proportion to the sowing, but in the later years the amount of the original seeding becomes of small significance compared to the influence of proper manuring and general management. Speaking generally pasture conditions favour the valuable indigenous species better than meadow conditions. On poor soils especially we are accumulating evidence to show that rape (folded on the land) is a much better nurse than oats or barley (removed from the field).

3) Our indigenous herbage plants offer a promising field for study. Nor should modern investigators confine their attention to grasses and clovers only, with the exception of but a few miscellaneous herbs. The authors of the present paper have been struck in the course of their work by the extent to which such plants as *Juncus squarrosus*, *J. Gerardi*, *J. articulatus*, *Bellis perennis*, and *Statice maritima*, are relished by stock.

It is, however, most desiderable to study the locally successful varieties of *Festuca ovina*, *Festuca rubra*, (with the other fine leaved fescues), *Poa trivialis*, *Poa pratensis*, *Lolium perenne*, and *Cynosurus cristatus*, with a view to estimating their relationship to the commercial counterparts and if necessary with a view to establishing local supplies of the indigenous seed.

The plants occuring in the district studied are given in classified lists of primary, secondary, locally secondary, locally exotic and exotic species.

A bibliography of 20 references is appended.

1278 – **Comparative Yields of Hay from Several Varieties and Strains of Alfalfa in South Dakota, U. S. A.** — HUME A. N. and CHAMPLIN M., in *South Dakota State College of Agriculture and Mechanic Arts, Agricultural Experiment Station, Bulletin* No. 163, pp. 282-243. Brookings, South Dakota, January 1916.

Various kinds of alfalfa were tested at the Stations at Brookings, Highmore, Eureka and Cottonwood from 1913 to 1915.

The following results were obtained from strains of *Medicago sativa*, tested on plots of one tenth acre in extent.

| Strain | South Dakota number | Serial plant introduction number | Average yield per acre |
|---|---|---|---|
| | | | lbs. |
| Vale | 22 | — | 2 565 |
| Grimm | 162 | 29 988 | 2 532 |
| Turkestan | 240 | 981 | 2 527 |

The yields given above are those of the first cutting only, as the second cutting was made after the alfalfa had seeded. The differences are too small to allow definite conclusions to be drawn as to the relative value of the three strains. Sometimes, however, Turkestan seed is unfavourably regarded on some of the Eastern markets, while the others meet with approval.

Strains of *Medicago falcata* were tested at Brooking from 1910-1915, with the results shown in the following table :

| Strain | South Dakota number | Serial plant introduction number | Average yield per acre |
|---|---|---|---|
| | | | lbs. |
| Obb . . . . . | 42 | 20 452 | 2 865 |
| Kharkow . . . . . | 47 | 20 717 | 2 046 |

These yields of hay were obtained from one cutting ; usually *Medicago falcata* can only be cut once in a season, and consequently it does not give such good crops as strains of *Medicago sativa*, which always produce a second and even a third cutting.

The paper under discussion gives a very detailed history of the introduction of different kinds of alfalfa into South Dakota, with a full description of the various strains of *M. sativa* and *M. falcata*. Numerous strains of alfalfa seem to be natural hybrids between the two species, and on this assumption they have been named *Medicago media*. The strains of *M. media*, *M. ruthenica* and *M. platycarpa* which have been introduced into South Dakota are described.

1279 – **Silage from Green Forage in Java.** — Shimmel E., in *Teysmannia*, Year XXVI, No. II. Batavia, 1915.

In many parts of Java there is a dearth of green forage during the dry season (east monsoon) and consequently the feeding of the livestock is often very defective.

Attempts have been made in the Buitenzorg Gardens to make silage from a Bengal grass (*Panicum maximum*) which is often grown in Java. The silos consisted of holes dug in well drained soil, and were 3 feet deep and 6 feet across. Each was filled with 2860 lbs. fresh grass in full flower, about three months old, care being taken to slightly raise the centre of the heap so that the rain should run off quickly. When the silos were three parts full they were covered with large stones and then with a layer of earth 16 inches thick to prevent any penetration of air. They were opened three months later and then contained acid silage of high quality which was much appreciated by the animals.

It was found that 50 per cent of the fresh grass was converted into useful silage after making allowance for loss of water and for the grass

which was spoiled by contact with the sand at the sides of the silo, 20 to 30 per cent of the nutritive constituents of the fresh grass were lost in the process of conversion into silage, except as regards fats and mineral substances. A mixture of equal parts of fresh forage and *Panicum maximum* silage is recommended for use in times of scarcity.



1280 – **The Cohune Palm *(Attalea Cohune)* and its Products** (1). — MORRIS C. D., in *La Hacienda*, pp. 376-379. Buffalo, N. Y., September 1916.

The fruit of this palm contains a kernel which yields about 40 per cent of an oil that is said to be superior to cocoanut oil. It has been extracted for several years and has been used in place of ordinary burning oil. As a matter of fact this palm oil is suitable for other more important commercial uses. The Cohune grows in the region between South Mexico and Columbia and attains its best development in British Honduras, Guatemala and the Honduras Republic. In the latter country the soil of the forests is rich, marly, and of excellent quality. The trees grow about 5 yards apart and the fruits form enormous bunches which sometimes weigh as much as 165 lbs. each. The average yield of one tree is 1 000 nuts per annum, though some specimens will produce twice as many. By means of ether rather more than 40 per cent of oil can be extracted from the kernel ; the cake contains 2.5 per cent of nitrogen and can be used as cattle food.

Cohune oil saponifies easily and furnishes an odourless soap which may prove to be useful in the manufacture of fine soap. The fibrous pericarp, which is about ¼ inch thick, also contains some fat. If factories are put up for the extraction of the oil from the kernels by means of solvents it might be worth while to extract the fats from the pericarps as well. When freed from fibre the fruit is 2-2 ½ inches long and about 1 ½ inches across. The shell is very hard and is about ¼ inch thick, while the kernel is as big as a large nutmeg.

In order to produce the oil on a large scale for export machines must be used to crack the stones. This is a very difficult problem to solve, as the machines must needs work with great force, with the result that the kernels are smashed as well as the shells.

This palm serves other useful purposes : houses are thatched with the leaves ; the leaf stalks are woven with osiers and cord into fences and mats ; the pith of the central stem can be used instead of cork for mounting insects ; cord and hammocks are made from the fibres of the young leaves. The sap makes a refreshing drink, which is not so much used now as formerly.

(1) See also *B.* 1913, No. 1038. (*Ed.*).

RUBBER, GUM AND RESIN PLANTS.

1281 – **Hevea in Java.** — I. VRIENS J. G. C., Planting and Thinning of Hevea, in *Mededeelingen van den Adviseur der A. V. R. O. S.* No. 4, pp. 45-49. — II. STET., The Fall of Young Leaves in Hevea. *Id.* pp. 59-60. Medan, 1916.

I. Various opinions are held as to the advantages of close planting of Hevea followed later by thinning out. The author puts forward the special advantage of this method in the upkeep of the plantations, and expresses his personal opinion that it is best to plant the trees 24 × 24 feet apart as a maximum and 19 × 18 feet as a minimum. The young plants should be very carefully selected from the nurseries.

The plantations must be kept well thinned in order that light can penetrate everywhere. Good drainage is essential and care must be taken that the water has free outlet. Pruning should be avoided and the plantations must be weeded every year.

II. The leaves of Hevea sometimes fall in the young stage. This defoliation always occurs after prolonged rains, and it is attributed to climatic causes, as no trace can be found of the presence of any cryptogamic disease.

1282 – **Some Experiments on the Coagulation of Hevea Latex without the Use of Acetic Acid.** — GERTER Dr. K. and SWART Dr. N. L. in *Mededeelingen van de Vereeniging Rubber Proefstation West-Java* No. 6, Bandoeng, 1916.

Thea author gives as result of his investigations on the coagulation of Hevea latex the following summary :

1. If latex with an addition of 0.3 per cent of sugar is allowed to stand overnight, coagulation occurs by lactic acid fermentation, putrefaction being inhibited.

2. The so called slow coagulation of latex by means of small quantities of acetic acid (0.3 gr. per liter) is also caused by lactic acid from bacterial growth.

3. In order to get complete coagulation by the sugar process the addition of 20 to 25 per cent of water to the undiluted latex may be recommended, this quantity being diminished according to the concentration of the latex received in the factory.

4. On a factory scale the following proportions have been used ;

175 L. lates, containing about 35 per cent of dry rubber.
50 L. of water.
400-450 gr. of sugar.

5 Under the above conditions the acidity of the serum after 18 hours has rather a constant value corresponding to 0.3 per cent of acetic acid.

6. The addition of serum of the former coagulation may sometimes be of use inhibiting putrefactive changes.

7. To prevent the formation of a coloured layer on the rubber it is advisable to pour water on its surface as soon as coagulation is setting in.

8. In laboratory experiments small quantities of bisulfite of soda had no disturbing influence upon the fermentation : on a large scale however the results hitherto have not been satisfactory.

9. The sugar process can only be used in preparing crêpe-rubber because of the porous state of the clot, gas bubbles being formed during the fermentation.

10. Other coagulants have been discussed, chiefly in view of the preparation of sheet-rubber.

11. Thereby attention was drawn upon the dangers involved by the use of coagulants such as sulfuric acid, *purub* and *aluin*.

12. The acidity of coconut water after fermentation did not exceed 0.45 per cent of acetic acid.

13. It was found that rubber prepared by the sugar process had the same viscosity index as a control sample made by means of acetic acid from the same batch of latex.

14. The mechanical properties were found to be identical.

1283 **Studies in Indian Sugarcanes, No. 2.** — BARBER C. A. (*Government Sugarcane Expert, Madras*), in *Memoirs of the Department of Agriculture in India* ("Sugarcane Seedlings, including some Correlations between Morphological Characters and Sucrose in the Juice") *Botanical Series*, Vol. VIII, No. 3, pp. 103-198. Plates I-XXIX and numerous tables. Calcutta, July 1916. SUGAR CROPS

The present contribution to the study of sugarcane seedlings in India is divided into 4 sections. The first of these deals with the material available and contains an enumeration of the seedlings thus far raised, with notes as to the chief difficulties encountered and the means by which thes have been overcome. The second discusses the differences noted in the youthful characters of the seedlings before planting out and at maturity. The next section treats of the mode of analyses adopted and the variations in the juice of the seedlings as regard sucrose content, and the last summarises the correlations thus far studied between the characters of mature seedlings and the amount of sucrose in the juice.

The experiments were conducted at the Government Cane Breeding Station at Coimbatore in the Madras Presidency with a certain amount of preliminary work at the Botanical Garden attached to the local Agricultural College.

I. — ENUMERATION OF THE SEEDLINGS RAISED. — The failure of previous sporadic attempts at raising cane seedlings in India is probably due to the fact that fertilization was not property effected owing to the immature state of the pollen used. A detailed study of cane inflorescences has shown that the pollen is only fully developed where the anther locales have dehisced. It has been found that if the authers do not open when the flowers mature they remain closed permanently ; it is therefore clear that the first essential to raising canes from seed is that only flowers should be used in which the anthers dehisce.

The sugarcane commences to flower at Coimbatore in October and most of the seedlings are obtained during the following 2 months. They are plantd out in the field when about 6 months old and are ready for harvesting and analysis after another 12 or 18 months from sowing. In this way the seed lings obtained during any particular season are designated by the years of sowing and of chemical analyses.

TABLE I. — *Vitality of Sugarcane Seed.*

| Variety | Date of collection | Germination | February 1 | March 1 | April 1 | June 1 | July 1 | August 1 | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| Madras N°2 . . | 9th Dec. 1914 | 500 | 500 | 300 | 200 | 100 | 20 | 0 | Equal quantities of pounded arrow were sown in the first five. Some seed remained capable germination for sown months. The seed of Saretha survived the longest and that of B 208 had least vitality. |
| Madras N° 6 . . | 15lhDec. 1914 | 500 | 500 | 300 | 200 | 100 | 20 | 0 | |
| Saretha. . . . . | 14thDec. 1914 | 500 | 500 | 500 | 300 | 200 | 40 | 0 | |
| Java . . . . . | 4th Jan. 1915 | 500 | 500 | 300 | 100 | 50 | 0 | 0 | |
| B. 208 . . . . . | 5th Jan. 1915 | 500 | 500 | 300 | Less than 100 | 12 | 5 | 0 | |
| Striped Mauritius | Do . . . . | 200 | 200 | 100 | 50 | 12 | 0 | 0 | A less quantity of arrow sown. |

During the periods 1911-13, 1912,14, 1913-15, 1914-1916, several thousands of seedling were raised from seed derived from local varieties or from arrows collected from various parts of India. The data relating to these seedlings — parentage (whether selfed or crossed), percentage of open anthers, germination etc. — are collected, in a series of tables. In the present summary space only allows of attention being paid to points, of more general interest. For instance. in 1914, owing to the somewhat saline nature of the soil of the experimental plots and to the quality of the irrigation water, some interesting data were obtained as to the great variation in the capacity of different canes to resist saline soil and water, some growing strongly and rapidly while others die out completely.

The stody of the cause of arrowing in the cane has led to frujtful results, There are 2 cane-planting seasons in the neighbourhood of Coimbatore, one in February-March and one in July-August or even later. The former is in vogue on garden-land irrigated by wells and the latter on wet lands under tanks. From a special study of each field from which arrows were obtained in the neighbourhood it soon became evident that canes planted in February-March do not usually flower while those planted at any time between Aug.-Nov. do so in the following Oct.-Nov. if allowed to remain in the ground. In the wet land generally the canes are more likely to flower and this has found to be the case even when they are planted as early as April-May. The result of an experimental arrowing plot under these latter conditions was eminently satisfactory. Among others, some 12 North India canes bore arrows, some for the first time on record. Unfortunately, in most of these the stamens remained obstinately closed but it is hoped to overcome this drawback by crossing a hardly North Indian indigenous cane with a richer exotic one provided they can be induced to flower simultaneously.

During the last period, 1914-1916, experiments were carried out on the

vitality of cane seed. The results, as shown in the appended table I are interesting as it is evident that, with proper care, cane seed retains its vitality for a condiderable period.

II. — Variation in Morphological Characters. — Under this heading are considered variations in vigour and size, general habit, erectness of young shoots, tillering, width and colour of leaves, colour and thickness of canes. Between some of these characters a certain amount of correlation is observed which, though not definitely settled, at least gives the impression that further study will show that certain infantile characters of the seed lings will be found to be related. If this can be proved, a great step in advance will be made as all present indications point to the fact that any classification of the cultivated sugarcanes must be based on the accumulation of a number of often very minute morphological characters, which, taken together, give the plant an indefinable but real mode of habit. With regard to vigour and size the seedlings of any batch though raised under identical conditions differ greatly in size and vigour. In many cases it has been noted that seedlings standing out from the rest because of their great growth, have a comparatively low sucrose percentage in the juice. Excessive vigour in a seedling, otherwise than a cross, is therefore not altogether a desirable character.

III. — Variation in the Sucrose Percentage in the Juice. — In addition to the usual " bulk " analyses of the juice at harvest time, a series of preliminary (" petty ") analyses were made before that date as the seedling of different parentage vary very considerably in their order of ripening and the petty analyses give an idea as to the order in which the plots should be cut for final analysis.

Later on, as the bulk analysis at crop time was not considered a sufficiently safe guide, it was decided to select from the series of analyses of any seedling, that containing the highest reading of sucrose. In doing this, however, due regard was paid to the percentage of glucose and the botanical description made at crop time.

The accompanying table II giving details of the amount of sucrose in the juice of parents and seedlings shows considerable variations in the sucrose content of seedlings of the same parentage. There is also a definite relation between parent and offspring in this respect, the better parents producing the better seedlings. The analyses of the special crosses also show that the sucrose in the seedlings approximates to the average of the two parents. In other cases the average sucrose of the seedlings is generally lower than that of the parents but this may be due to the fact that it was not always possible to analyse a seedling at its optimum.

Table III shows the effect of different soil and environmental conditions on the quality of the juice of seedlings. It will be seen that the seedlings respond readily to changes in soil and water.

The question as to the permanence of the juice characters of cane seedlings when propagated as sets has been studied but the data are as yet insufficient for definite conclusions to be drawn. Both the period of the year at which canes are cropped and the nature of the weather appear to influence

TABLE II. — *Comparison of sucrose in the juice in parents and seedlings, 1912-14.*

| | Parents | | | | Seedlings | | | |
|---|---|---|---|---|---|---|---|---|
| | Number of analyses | Locality | Range of sucrose % | Average sucrose % | Number of seedlings analysed | Locality | Range of sucrose % | Average sucrose % |
| Chittan | 5 | Cane Breeding Station | 15–18 | 16.67 | 500 | Cane Breeding Station | 8–21 | 14.7 |
| Karun | 3 | do. | 15–18 | 16.02 | 345 | do. | 10-20 | 14.7 |
| Kaludai Boothan | 4 | do. | 14–20 | 16.78 | 60 | do. | 10–17 | 13.8 |
| Saretha | 5 | Aligarth Farm 1913 | 13–17 | 14.59 | 51 | do. | 1–18 | 14.6 |
| | 15 | Cane Breeding Station | 11–17 | 13.83 | | | | |
| | 4 | Wet Lands Coimbatore Central Farm | 18–19 | 18.91 | | | | |
| Cheni | 12 | Cane Breeding Station | 11–14 | 12.67 | 19 | Botanic Garden Coimbatore 1913 | 9–15 | 12.2 |
| | 5 | Wet Lands Coimbatore Central Farm | 18 | 17.67 | 16 | Cane Breeding Station 1914 | 13–17 | 15.2 |
| | 10 | Mysore | 16–19 | 17.01 | | | | |
| Poovan | 5 | Cane Breeding Station | 13–17 | 14.61 | 17 | do. | 12–20 | 15.0 |
| Naanal | 12 | do. | 9–16 | 12.36 | 180 | do. | 5–17 | 10.5 |
| | 3 | Wet Lands Coimbatore Central Farm | 15–17 | 16.37 | | | | |
| Chin | 9 | Cane Breeding Station | 12–16 | 13.81 | 18 | do. | 6-12 | 9.0 |
| | 7 | Wet Lands Coimbatore Central Farm | 16–18 | 17.30 | | | | |
| × *Saccharum spontaneum* | 7 | North India | 14–15 | 14.78 | | | | |
| | — | Cane Breeding Station | 3–5 | 4.00 | | | | |
| Shakarchynia | 5 | do. | 9–16 | 12.94 | 81 | do. | 6–13 | 9.8 |
| | 4 | Sabour Farm Taylor 1911 | 17 | 16.94 | | | | |
| × *Saccharum spontaneum* | — | Cane Breeding Station | 3–5 | 4.00 | | | | |

TABLE III. — *Comparison of the price of seedlings grown under different conditions* (all bulk analyses).

| Seedling and its parentage | Garden Land at Coimbatore (well irrigated) | | | | | | | | Wet land in Central Farm Coimbatore tank irrigated | | Adhartal Farm Jatbulpore | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Botanic Garden 1913 [1] | | Cane Breeding Station A 1914 | | Cane Breeding Station B 1914 | | Cane Breeding Station B 1913 | | 1915 | | 1914-1915 | |
| | Sucrose | Glucose | Sucrose | Glucose | Sucrose | Glucose | Sucrose | Glucose | Sucrose | Glucose | Sucrose | Glucose |
| Madras N° 2 (Kaludai Boothan). . | 11.55 % | 1.53 % | 10.24 % | 0.71 % | 13.18 % | 0.52 % | 12.21 % | 1.11 % | 14.58 % | 0.67 % | 15.21 % | 1.24 % |
| Madras N° 6 (Poovan) . . . . . | 11.88 | 1.45 | 7.95 | 1.32 | 9.60 | 0.94 | 9.34 | 1.43 | 13.83 | 0.48 | 13.04 | 1.60 |
| Madras N° 11 (Poovan) . . . . . | 12.40 | 0.92 | Failed | | 13.64 | 0.65 | 16.09 | 1.10 | 17.26 | 1.00 | — | — |
| Madras N° 19 (Cheni) . . . . . | 11.43 | 0.22 | 12.89 | 0.86 | 12.64 | 0.65 | 13.26 | 0.48 | 16.75 | 0.10 | 12.74 | 1.12 |
| Madras N° 21 (Cheni) . . . . . | 12.36 | 0.16 | Failed | | 12.50 | 0.17 | 15.07 | 0.52 | 18.20 | 0.30 | 14.49 | 1.02 |
| Madras N° 25 (Cheni) . . . . . | 14.68 | 0.10 | 11.86 | 0.51 | 12.56 | 0.56 | 13.96 | 0.81 | 15.72 | 0.33 | 14.63 | 0.90 |
| Madras N° 29 (Cheni) . . . . . | 15.33 | 0.10 | 9.79 | 0.38 | 13.61 | 0.30 | 15.55 | 0.17 | 17.32 | 0.10 | — | — |
| Madras N° 45 (Cheni) . . . . . | 10.05 | 0.17 | 10.83 | 0.61 | 15.81 | 0.65 | 11.74 * | 0.67 | 17.78 | 0.29 | 14.71 | 1.02 |
| *Average* . . . | 12.31 % | 0.58 % | 10.59 % | 0.73 % | 12.95 % | 0.55 % | 13.40 % | 0.79 % | 16.43 % | 0.41 % | 13.13 % | 1.15 % |
| *Average of five grown at all places* . . | 11.94 % | 0.69 % | 10.75 % | 0.80 % | 12.76 % | 0.66 % | 12.10 % | 0.90 % | 15.73 % | 0.37 % | 14.07 % | 1.18 % |

[1] First year seedlings grown in large pits filled with good soil but irrigated with brackish water.
In 100,000 parts of water: — Total solids 239, injurious salts 165, sodium chloride 127.
A — Set plants grown first year from seedlings — in small pits filled with good soil; earth around saline; and irrigated at any rate at first with brackish water.
In 100,000 parts of water: — Total solids 342, injurious salts 249, sodium chloride 189.
B — Set plants grown first and second years from seedlings — in smaller pits filled with good soil; earth around slightly saline: irrigated with sweet water.
In 100,000 parts of water: — Total solids 91, injurious salts 53, sodium chloride 33.
* 14.82 in petty analyses, therefore probably over ripe.

considerably the character of the juice. Extraordinary variations have ben met with in a seedling in analysing the different canes in the clump. This has led to increased care in sampling and the discovery that certain varieties produce, in a given clump, two kinds of cane, differing both in certain morphological characters and in time of origin. In analysing the juice of canes this classification into early and late varieties cannot be ignored.

Taking the whole series of *selected* seedlings during the last 3 seasons, it is seen that the sucrose content in the seedlings has risen continuously as follows :

TABLE IV. — *Sucrose in the Juice of Selected Seedlings.*

| | Number of seedlings grown | Over 17 % | Over 18 % | Over 19 % | Over 20 % | Over 21 % | Over 22 % | Over 23 % | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 1911-1913 (over 17 %) | 48 | 2 | — | — | — | — | — | — | All the seedlings were grow on |
| 1912-1914 (over 17 %) | 2,068 | 95 | 40 | 9 | 2 | — | — | — | The standard of selection, 17 % sucrose in the juice and over. |
| 1913-1915 (over 18 %) | 2,400 | 400 | 128 | 101 | 22 | 3 | 1 | 1 | The standard of selection, 18% sucrose in the juice and over, together with vigorous growth. |

IV. CORRELATION BETWEEN MORPHOLOGICAL CHARACTERS OF SEEDLINGS AND RICHNESS OR THIR JUICE. — The advantages that would accrue, as regards economy of time and trouble, trom the discovery of correlations between morphological characters of the young seedlings with richness in juice are obvious ; but there are special difficulties in the way and the principle has been adopted of trying first to find such correlations in mature canes at crop time and later to attempt to correlate infant and mature characters. The first step alone has been tried at present and the following correlations have been studied between mature characters and sucrose in the juice, the results being summarised in table V appended: — correlation between the amount of sucrose in the juice and various leaf and cane measurements (width, length and module, or length divided by width) and colour of cane, and correlations between leaf width and thickness of cane, tillering power and total weight of seedling.

TABLE V. — *Summary of Correlations.*

| | Chittan | Karun | Kaludai Boothan | Saretha | Cheni | Poovan | Naanal | | Shakarchynia × *Saccharum spontaneum* | Vellai × *Saccharum Narenga* | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of seedlings dealt with | 477 | 323 | 54 | 46 | 18 | 13 | 65 | 71 | 65 | 80 | |
| Leaf width and sucrose | — | — | — | — | — | + (1) | + ? | + | o | + ? | (1) The numbers are so few that a single seedling has turned the scale. |
| Leaf length and sucrose | — | — | — | — | — | — | — | — | ... | o | |
| Leaf module and sucrose | + | + ? | + | + | + | o | — | — | ... | — | |
| Cane thickness and sucrose. | o | — ? | — ? | — ? | — | + | + ? | + ? | + ? | + | |
| Cane length and sucrose | + (2) | + (2) | + ? (2) | + ? (2) | + | o | o ? | o ? (2) | + (2) | + (2) | (2) In 10 out of 16 cases where 4 classes were possible, the curve is quite distinct and peculiar. There is a steady rise in the first three classes, followed by a fall in the fourth. In 4 of the remaining 6, the third class, still has the highest sucrose (Cf. p. 150). |
| Cane module and sucrose. | + | + | + ? | + ? | + | + | — (3) | — (3) | — (3) | + | (3) In Naanal and Shakarchynia × *Saccharum spontaneum*, the curves are similar, there being a rise from the first to the second class, followed by a fall from the second to the fourth (cf. p. 182). |
| Leaf width and thickness of stem | + | + | + | + | + | o | o | o | + ? | + | |
| Leaf width and total weight | + | + | + | + | + | + | + | o (4) | o (4) | + | (4) In Naanal and Shakarchynia × *Saccharum spontaneum*, the first and fourth classes are much the largest and the second and third considerably lower. (cf. p. 186). |
| Leaf width and tillering | — | — | o | + | — | + | ... | ... | — ? | — ? | |

STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL PLANTS

1284 - **Coffee in Java.** — I. CRAMER P. J. S. *Coffea excelsa* in Java, in *Teysmannia*, Year XXVII, Nos. 4 and 5, pp. 211-223. Batavia, 1916. — II. KEUCHENIUS P. E. Notes on the Fertilization of *Coffea excelsa* in Java, in *Mededeelingen van het Besoekisch Proefstation*, No. 20. Surabaya, 1915.

I. *Coffea excelsa* was discovered in the Congo in 1904 by A. CHEVALIER, and it was introduced into Java through the State Agricultural Station, which received some seeds from the Colonial Garden at Nogent-sur Marne (France) It resembles *Coffea liberica*, from which it is distinguished by some secondary characters, especially by the smaller fruits. The berry has a soft watery pulp and a tender skin which is easily removed.

Various types of plants were raised from the first seeds introduced into Java and careful selection will be necessary to obtain a good stock for cultivation. During the extraordinary and prolonged droughts of the last few years *Coffea excelsa* has shown greater powers of resistance than other species of coffee.

Investigations on selection and on the best methods of cultivation are being carried out at the State Experimental Station.

II. Observations have been made on the different ways in which coffee is pollinated, as insects are almost entirely absent from the plantations. The relative positions of the stamens and pistil in the flower makes self-pollination very difficult. The pollen is easily shaken down on lower flowers, and it is also carried by the wind. It is therefore probable that self fertilization is very rare, and that most flowers are cross-fertilized.

1285 - **New Method of Detecting Adulteration in Tea.** — REHFOUS L., in *Bulletin de la Société botanique de Genève*, 2nd Series, Vol. VIII, Nos. 1, 2 and 3, pp. 24-28. Geneva, January, February and March, 1916.

The method is based on examination of the stomates, which are quite different in *Thea sinensis* from those in any of the other leaves used for adulteration. In the stomates of *Thea* the guard cells possess, on their inner surface, a very strongly marked layer of cutin which is prolonged into a beak or hook, and which is distinct from the beak which closes the ostiole.

Various kinds of tea have been examined. The stomates of Pecco tea are strongly cuticularised and possess the characteristic hooks. Ceylon tea is made from rather young leaves in which few of the stomates are fully developed; the cutin is less marked but the hooks are plainly visible although they are not very well defined. Both characters are also evident in Java tea, black tea (Souchong), Imperial, Congo, Russian tea from West Caucasus, Shangai green tea, Chinese yellow tea, green tea from South Mongolia. The same characters appear even in the sepals of *Thea sinensis*.

The only leaf used for adulteration that bears much resemblance to that of *Thea* is the *Camelia* leaf. A transverse section of one of the latter leaves shows that the stomates are quite different from those of *Thea*. for though they are strongly cuticularised the hooks are but very slightly developed.

1286 – **Investigations about the Dying out of Peppervines in the Dutch East Indies.** — II **Pepper-cultivation in Banka.** — RUTGERS A. A. L., in *Mededeelingen van het Laboratorium voor Plantenziekten* No 19, with illustrations. Batavia, 1916.


SUMMARY

I. Pepper was introduced in Banka about 40 years ago by Chinese from Riouw. Since 20 years the Bankanese (Malay natives in Banka) have been planting pepper, imitating the Chinese. The export from Banka amounted in 1913 to 2 ½ million *guilders* (over £ 200.000).

II. Pepper-cultivation in the Dutch East Indies has two distinct forms: on the one hand the cultivation, as practised since many centuries by the Malay in Sumatra, a form of agriculture based on exhausting the virgin soil and leaving it alone afterwards, on the other hand the cultivation, as practised by the Chinese a refined form of horticulture. The pepper cultivation in Banka is of the latter type.

III. The pepper-cultivation by the Chinese in Banka is marked by the following characteristics:

A. The pepper is grown at dead stakes without shadow.

B. By careful tillage, big plant holes, big burying-trenches and the use of first rate cuttings for planting vines are grown with an extensive and vigorous root system.

C. The pepper vines continue producing 20 or even 30 years as a result of careful cultivation and abundant manuring with " burnt earth ", oil-cakes, cattle manure, fish manure etc.

D. The average production of each vine amounts to 3 kattie (= 4 lbs.) white pepper a year.

IV. The pepper cultivation by the Bankanese is a cheap imitation of the cultivation by the Chinese. Tillage, burying of the young vines and manuring are usually neglected. The vines are dying out within 9 years; the production of each vine is less than 1 kattie (= 1.3 lbs.) white pepper a year.

V. The following diseases and pests have been found in Banka:

A. Prematurely dying out as a result of planting in unsuitable soil.

B. Prematurely dying out as a result of insufficient care.

C. The leaves are eaten by a beetle (Holotrichia spec.)

D. The stems are eaten by termites.

E. The fruits are damaged by a small weevil, which eats small holes in the unripe seed.

F. On the leaves lice have been found.

G. Larvae have been found boring in the branches.

H. A cobweb fungus has been found on the leaves.

VI. The peppervines of the Bankanese show a marked difference from those of the Chinese: the last-named ones produce 4 lbs. white pepper a year during 20 years, the first-named ones three times less during one third of that time.

There is no other reason for this difference than the careful cultivation

by the Chinese and the neglecting of several necessary measures by the Bankanese. Which of the measures of the Chinese is the most important cannot be stated theoretically. Only experiments especially arranged for this purpose can settle this point.

1287 – **Notes on the Extraction of Citronella Oil.** — Jong A. W. K., in *Teysmannia*, Year XXVII, Nos. 4 and 5, pp. 246-252. Batavia, 1916.

Experiments have been made which show that the drying of citronella leaves (*Andropogon Nardus*) before distillation gives good results. Drying in the sun must be avoided, as this causes a rather heavy loss of essential oil.

Leaves that have been cut into pieces from 3 to 5 cm. square are more easily extracted than entire leaves. In the process of distillation care must be taken not to use any un-tinned metal tubes, as lead and copper form sulphates which discolour the oil.

1288 – **Tobacco Growing in the Illyrian Region.** — Baldacci A., in *Ministerio delle Finanze, Direzione generale delle Privative, Bollettino tecnico della Coltivazione dei Tabacchi pubblicato per cura del R. Istituto Sperimentale in Scafati (Salerno)*, Year XV, Nos. 1 and 2, pp. 3-28. Scafati, January-February and March-April 1916.

*Dalmatia.* — Tobacco growing has been carried on in the Illyrian region for some centuries, and after the annexion of Dalmatia to Austria it became a monopoly. The Austrian Government then experimented with Herzegovinian tobacco and obtained good results by selection. Afterwards a long series of investigations were made with Macedonian tobacco and later still with American types. In 1863 Trebinyan tobacco was acknowledged as the best, and the other types were gradually given up.

When cigarette smoking came into fashion experiments were begun (1884) to improve the cigarette tobacco. These trials were carried on in Southern Dalmatia, as this was the only country in Austria-Hungary which produced this type of tobacco. Herzegovinian (Trebesat and Megiugorge) and Turkish (Giubek-Yakà, Kir-Yakà, Porsician, etc.) types were tested; Sumatra types were also tried, but were quickly abandoned as they gave such poor results. During the next twenty years the Dalmatian hybrids deteriorated more and more rapidly on account of imperfect selection, so fresh improvements were made. The best results were obtained by crossing Macedonian and Herzegovinian tobaccos. This method however, brought two difficulties in its train:

1) A great lack of uniformity in the crops was caused by the intercrossing which occurred owing to the presence of so many different varieties in the country.

2) The climatic and soil conditions caused the plants to revert to the wild type.

The Government was thus compelled to attempt fresh improvements:

1) To raise good hybrids adapted to the climate and soil of the different localities;

2) To fix and acclimatize the hybrids;

3) To obtain uniformity of crop by means of a suitable choice of seed ;

4) To establish government institutes for the production and control of tobacco seed.

In 1904 experiments were begun at Imoski and artificial crosses were made between Herzegovinian types (Stolatz and Drinovtzi) and Macedonian tobaccos (Kir and Giubek), the first crop from original seed being used for parents. The following crosses were made :

| | |
|---|---|
| Drinovtzi × Giubek | Giubek × Drinovtzi |
| Drinovtzi × Giubek | Giubek × Drinovtzi |
| Drinovtzi × Kir | Giubek × Stolatz |
| Stolatz × Giubek | Kir × Drinovtzi |
| Stolatz × Kir | Kir × Stolatz. |

The resulting hybrids were grown in 1905, and the descendants of the cross between Drinovtzi and Kir were much better than their parents. These hybrids were again crossed with one of the parents, thus :

| | |
|---|---|
| Drinovtzi × Giubek$^2$ | Stolatz × Giubek$^2$ |
| Drinovtzi × Kir$^2$ | Stolatz × Kir$^2$ |

After 1909 the trials were more and more improved by the use of Angeloni's method. It had been proved that the distance between the plants has a very great influence on their character and qualities, so that the more the distance between the rows and between the plants in the rows was reduced the more closely did the hybrids in the plantations approach the Macedonian type in character.

After 1908 the American method of race improvement by artificial self-fertilization was also practised on Giubek.

The chief facts established by the Imoski and Sinj trials are as follows :

When Herzegovinian tobacco is crossed with a Macedonian type the hybrids in the first two generations almost equal the taller parent in height, but in the later generations the height decreases, at first rapidly, then more and more slowly ; the number of leaves behaves in the same way as the height. The maximum length and breadth of the leaves, after the first cross, rapidly and constantly decrease, and may throw back to that of the smaller of the parents ; the ratio, length : breadth, of the leaves increases from the first and approaches, but never quite equals, the ratio of the Macedonian parent.

When a Macedonian tobacco is crossed with a Herzegovinian type the number of the leaves and the height of the hybrids decrease steadily after the first generation ; the length and breadth of the leaves increase normally ; the ratio, length : breadth, decreases from the beginning and approaches, but never quite equals, that of the Herzegovinian parent.

Similar regular gradations can be proved with regard to length of internodes, number of flowers, the arrangement of the inflorescence, size of angles of insertion and the strength of the leaf venation.

In a series of hybrids the nicotine content increases with the Macedonian element and decreases with the increase of the Herzegovinian element ; the first crosses behave in different ways according to the particular combination of parents, so that no general rule can be laid down.

*Albania.* — Tobacco can be grown in all the regions of the lower plains (Scutari basin, Musakia plain, Diakova and Prisrend basin, plains of the great Albanian lakes, valleys of Argyro-Kastro, Janina and Lapsista) but the crop is of little importance in the country. While Albania might have been a great tobacco market she occupies, in regard to this crop, the lowest place among the provinces which were formerly included in Turkey in Europe : her production rarely covers her consumption.

Tobacco growing was taken over by the Turkish Government in 1878, at the time when the vilayets of Epire and Monastir and the Durazzo Sanjak (vilayet of Scutari) were under Turkish rule.

The Albanian tobacco now closely resembles the Montenegran type in character ; it was derived from Herzegovinian types by the old method of crossing. If the plants are grown very far apart the leaves sometimes develop enormously with very pronounced ribs ; in spite of this the texture is usually rather fine for such a large leaf. The dominant colour is generally light maroon, more rarely yellow ; the upper leaves ripen with difficulty, because the plants lose their flowers too soon. Even the best samples, such as those from the Scutari province, are too strong for cigarette tobacco and have little aroma. Possibly the lack of flavour may be due to defective methods of preparation, but this can be remedied by suitable mixing.

The tobacco seeds are sown in February and transplanting begins in April ; one to three weedings are given, one being the most usual number. Harvesting starts in August, and the leaves are threaded on strings, which are taken under cover as soon as damp weather sets in. No trouble is taken to select uniform leaves, and the strings are made up of all qualities and colours. After harvesting, the leaves are sold to manufacturers who turn them into fine pipe and cigarette tobaccos. All the work is carried out by hand labour.

Considering the economic condition of Albania it is doubtless advisable to suggest the continued growing of the yellow Herzegovinian types, which are suited to the soil and which have been improved by crooss breeding carried out by the Austrian Government in Dalmatia and by the Italian Government in the Lecce province. Tobaccos of this type are easily acclimatized in warm and dry soils, they do not need stopping nor special cultivation, they can be dried in the open air in the sun (they do not even need special places for treatment) and they need little hand labour in manipulation for market.

The growing of Giant Herzegovina might be tried in the Albanian region. The Scafati station obtained the original seeds from Dalmatia, and by careful selection very large plants have been raised, with 50 to 70 leaves on a stem, 3 or 4 times as many as in ordinary Herzegovina. At the present time the variety is grown on a large scale in the Lecco province, where it

yields from 2 570 to 2 646 lbs. of leaves per acre. The only fault of this plant is that the topmost leaves are lost because they ripen very late. It is very probable that Giant Herzegovina corresponds to the Austrian Gradatz which was apparently obtained it in 1908 in the Sinj Experimental Station by natural crossing probably with a Turkish tobacco. This vigorous type might be used in Albania as a basis for hybridization. Besides this, recourse might be had in Albania (as has already been done in Montenegro) to the growing of certain Macedonian types belonging both to the Bashi-Bagli group with stalked leaves and to the Basna group with sessile. leaves. It would be necessary to restrict these to districts where the growers were willing and able to manipulate the produce carefully.

Without doubt Porsician, which is a good Bashi-Bagli, should be tried first, as it has given good results in the Lecce province, and it is occasionally met with in very restricted areas in Central Albania. Other types might then be tried, including Zinha, Mahala, Edyrnegik, Kirs, Xeres, Aya-Soluk, Samsun etc. besides many other varieties of tobacco, from temperate or subtropical zones, differing in type from the Herzegovina and Macedonia tobaccos, such as Maryland, Burley, Italia × Kentucky, Bright etc. On the other hand tropical types of tobacco such as Sumatra, Java, Havana, Saint Dominique, and Bresil, do not succeed in Albania because they are not suited to the climate of this region.

1289 – **New Varieties of Italian Tobacco, Resistant to *Thielavia basicola*** (1). — BENINCASA M., in *Ministero delle Finanze, Direzione Generale delle Privative, Bollettino Tecnico della Coltivazione dei Tabacchi pubblicato per cura del R. Istituto sperimentale in Scafati* (*Salerno*), Year XV, Nos. 1, 2, pp. 29-33. Scafati, January-February and March-April, 1916.

In an earlier article (*Bollettino Tecnico del R. Istituto sperimentale di Scafati*, No. 5, 1914) the writer described some experiments which showed that the decline in the growing of Kentucky tobacco in some parts of Italy was due to root rot, and, as all other remedies proved useless, the planting of special resistant varieties was advised. In the present paper the best methods of growing these new varieties are discussed, and attention is drawn to their industrial characters and to the impetus that has been given to tobacco growing in the districts where they have become established. These varieties are chiefly hybrids and in addition to being resistant to *Thielavia basicola* they have other advantages from the growers' standpoint and they possess valuable commercial qualities. As these varieties are becoming more and more local in character they may be grouped according to the districts in which they are chiefly grown, as follows:

*Hybrids of Cava dei Tirreni.* — Numerous hybrids of heavy tobacco have been tested in this locality during the last few years, and Italia × Kentucky and Salento × Kentucky have become established.

According to Dr. ANGELONI, since Italia is a hybrid between Kentucky and Sumatra, Italia × Kentucky possesses the hereditary characte-

(1) See also *B.* 1912, No. 234. (*Ed.*)

ristics of Kentucky and Sumatra in the proportion 3 : 1. This variety is earlier and develops more quickly than Kentucky and it is much more resistant to root rot.

The tobacco is finer and lighter, with a stronger smell. It likes a fertile and open soil, and a rather warm climate. In localities other than Cava de Tirreni it has not always proved successful.

Salento is a hybrid between Kentucky and Cattaro, so that Salento × Kentucky possesses the hereditary characteristics of Kentucky and Cattaro in the proportion of 3 : 1 and is more resistant to root rot than is Kentucky. It is earlier and develops more quickly and also it is less exacting as regards soil and climate. But, like Italia × Kentucky, it is subject to rust after the first cold dews, especially when ripening is very late, so that it is not advisable to plant this variety in places where tobacco is attacked by oidium. It is more productive than Kentucky but is less valuable for commercial purposes.

When Italia × Kentucky is crossed with Salento × Kentucky the resulting strain (which is not yet properly fixed) combines the good qualities of each of the parent hybrids and eliminates their defects. It seems that repeated crossing of tobacco renews its vitality and increases its vigour of growth.

The introduction of hybrids into Cava de Tirreni has not only checked the decline in the growing of Kentucky tobacco but it has increased the yield per acre about 20 per cent. In addition to this less labour is needed, as the young plants root more easily.

*Pontecorvo hybrids.* — For several years the damage caused by root rot at Pontecorvo was remedied by the planting of Salento × Italia, but at the present time this hybrid is being gradually replaced by Moro × 3 Kentucky.

Salento × Italia from the phylogenetic standpoint possesses the characteristics of Kentucky, Cattaro and Sumatra in the proportion 2 : 1 : 1, and it is one of the varieties that are the most resistant to *Thielavia*. It is early, hardy, and very accommodating as to climate and soil, but is easily damaged by the wind as it has only a few spreading and fragile leaves, so that it is not recommended for distribution.

Moro × 3 Kentucky possess characteristics of Kentucky and Moro di Corvi in the proportion of 7 : 1. Botanically it differs little from Kentucky, but it is earlier and is sufficiently resistant to *Thielavia* to pass safely through the critical period of rooting when planted out. On the whole this may be called an improved Kentucky.

In order to increase the resistance of Moro × 3 Kentucky and the yield of Salento × Italia these two hybrids have been crossed with one another for two season, with very promising results.

*Salento in the Benevento region.* — Salento is a hybrid between Kentucky and Cattaro raised about 1900 at the Scafati Institute in order to obtain a low priced pipe and cigarette tobacco, and for several years it was grown for that purpose only in the region of Lecce and other parts of Italy. In 1906 experiments were made in the Benevento Gardens to remedy the trouble

caused by the wholesale loss of the young plants of the variety Burley, which was grown there at that time, and Salento was more successful than any of the other Italian hybrids. Salento shows the characters of both its parents. It is very vigorous, fairly early, and very adaptable as to soil and climate, it stands drought well, is very resistant to *Thielavia*, and is hardly at all susceptible to rust and öidium. Commercially it is inferior to Kentucky, chiefly on account of its percentage of large veins, but, under the conditions in which it is grown in the Benevento region it becomes much finer and resembles Seedleaf rather than Kentucky. In the Italian industry it has no equal as a substitute for Kentucky.

The average production of the Benevento Gardens was 1319 lbs. per acre when Brésil tobacco was grown ; the yield fell to 1167 lbs. with Kentucky and to 972 lbs. with Burley ; in 1914 it rose to 2050 lbs. with Salento.

As cigar tobacco Salento is only grown in the region of Benevento ; when it is planted elsewhere it easily loses its fine qualities.

To sum up, several new Italian varieties have been produced which are more or less resistant to root rot. The chief characters of these new varieties are as follows :

1) Most of them resemble Kentucky in their botanical and commercial characters but they are more resistant to *Thielavia*.

2) The less closely the hybrid resembles its parent Kentucky the farther removed is the product from the heavy type of tobacco. The first character to disappear is the compactness of the tissues, a quality which seems to be determined more by the environment then by anything else as in the Italian Kentucky the tissue is less compact than it was in the original Kentucky.

3) In spite of the lighter weight of the tissue the parent Cattaro considerably raises the yield, so that under normal conditions the hybrids of Cattaro are more productive than Kentucky, while all the others are less productive.

4) In addition to being more resistant to root rot the new varieties are earlier, they develop more rapidly and can stand drought better ; they are hardier and at the same time better adapted to the Italian climate. These qualities tend to become strengthened by repeated crossings.

5) New varieties of similar characters and constitution tend to become localised in distribution.

The introduction of these hybrids has had a considerable influence upon the production of the Kentucky type of tobacco in the three zones mentioned. In an appendix, the yield of the hybrids is compared with that of pure Kentucky.

1290 - **Experiments on Tobacco Fermentation in Java.** — De Vries O., in *Mededeelingen van het Proefstation voor Vorstendlandsche Tabak*, No. XXI. Samarang, 1915.

A plant has been invented to exhaust the air from the interior of fermenting stacks of tobacco, and the results obtained are described in the present paper. The apparatus consists of rings of perforated iron tubing which are placed at different heights in the stack and which are connected

with an air pump by means of tubes. Stopcocks regulate the suction in the various tubes, and the temperatures in the differents parts of a stack are registered by electro- thermometers. The object is to keep the temperature constant at a pre-determined point, as if this could be maintained for a certain time it would do away with the inconvenience of remaking the stack when the tobacco heats too much, a process which greatly increases the percentage of broken leaves.

This plant has been improved during the last year and has given good results with hands of tobacco placed in the middle of the stacks, while the rise in temperature can now be checked at any desired point. Unfortunately after the temperature has been lowered, the cooling process continues and cannot be stopped. The hands placed towards the outside of the stack do not derive any benefit from the aspiration of the air, and consequently the stack must be remade for their benefit. It is hoped that better results will be obtained by covering the stack with isolating material.

A large thermostat has been devised for regulating the rise and fall of temperature during fermentation, but the experiments so far have not have not given any positive results. Special tests have shown that during the first few days the lower layers of a stack heat up most, whereas later on the hands placed in the middle of the stack reach a rather higher temperature than those lower down.

Other experiments have shown that if the stacks are made too large and if moist tobacco is used they may overheat badly, resulting in serious deterioration in the tobacco, even if the overheating does not cause the stacks to catch fire.

FRUIT GROWING

1291 – **The Fruiting of Trees in Consecutive Seasons.** — PICKERING S., in *Journal of Agricultural Science*, Vol. VIII, Part I, pp. 131-135. Cambridge, September 1916.

Points of considerable interest, both scientific and practical, are raised by the question as to whether a tree which fruits exceptionally well as compared with its fellows in one season, will tend to fruit exceptionally well, or the reverse, in the following season. We know of no definite reason why the behaviour of a tree as regards fruiting should alternate in consecutive years, and no such behaviour has been observed in the case of animals. Its doing so would imply that fruiting is due to the gradual accumulation of some substance in the tree, which becomes exhausted whenever heavy bearing occurs, and that the stock of this substance does not become properly replenished till after another season has elapsed.

The difficulties in obtaining exact measurements of the relative behaviour of any two or more trees in consecutive seasons are considerable. The weight of fruit or the number of fruits may be recorded, but, unless the trees are absolutely similar in size, disposition of branches, situation, etc., which is impossible, the superiority of the one over the other as regards inherent fruiting capabilities may be misleading. On the other hand the trees under observation may be classified by inspection, grouping them according to the extent which they are loaded with fruit, independent of their size, and then comparing the classification in one year with that in

the following year. This method avoids errors due to difference in the size of the trees, but it has the disadvantage of being based on the judgment of the observer, and not on actual weights. This latter method was adopted in the case of one series of observations on trees at Harpenden, and the former in the case of the other series on trees at Ridgmont.

Whichever method of observation was adopted the results were treated as follows; two selected trees were numbered 1 or 2, according to which of them bore the heavier crop in consecutive seasons; then, comparing the results in two consecutive seasons, if the order of fruiting had been the same (consecutive fruiting) the difference between the numbers given to the trees would be 0, if the order had been reversed (alternate fruiting) the difference would be 1; whereas if neither consecutive nor alternate fruiting prevailed, and the results were dependent on chance or on external conditions, the differences would, on the average, be 0.5. An average difference, for instance, of 0.75 would be halfway between 1 and 0.5, indicating that the results were dependent on the alternating tendency to the extent of 50 per cent., and on chance fruiting to the extent of 50 per cent. Some of the results obtained by this method are given in Table I.

TABLE I.

| Place | Varieties | Dates | Instances | Fruiting indicated | | |
|---|---|---|---|---|---|---|
| | | | | Consecutive | Alternate | Chance |
| Harpenden | Several | 1899–1903 | 332 | 0 | 44 | 56 |
| Ridgmont | Bramley | 1904–1913 | 1 050 | 12 | 0 | 88 |
| » | Cox | 1898–1909 | 840 | 16 | 0 | 84 |
| » | Potts | 1897–1904 | 1 266 | 5 | 0 | 95 |
| » | Stirling | 1897–1913 | 366 | 0 | 6 | 94 |
| » | 117 varieties | 1906–1913 | 1 207 | 15 | 0 | 85 |

There can be no doubt but that the results at Harpenden and Ridgmont are very different, but the Harpenden results must be discounted to a certain extent as the number of instances available is smaller.

In Table II the yields from the Stirling Castle, Bramley and the Variety plantation are given, the numbers giving the relative magnitude of the crops compared, in the case of Stirling Castle, with the crop in 1900 as 100, and, in the other cases, with that of 1911 as 100.

A plus or minus sign has been placed after the values showing whether they are above or below the means of the preceding and succeeding seasons, and the extent to which these signs alternate, though not without some irregularities, is very remarkable. In the case of Cox and Potts no such alternations were recognisable. The chief factor affecting the alternation of bearing in early flowering varieties is the incidence of spring frosts.

TABLE II.

| | Stirling | Bramley | Varieties |
|---|---|---|---|
| 1897 | 3 | — | — |
| 1898 | 30 | — | — |
| 1899 | 6 — | — | — |
| 1900 | 100 + | — | — |
| 1901 | 47 — | — | — |
| 1902 | 144 + | — | — |
| 1903 | 0 — | — | — |
| 1904 | 148 + | 35 | 0 |
| 1905 | 0 — | 6 — | 0 — |
| 1606 | 144 + | 7 + | 12 + |
| 1907 | 38 — | 20 + | 20 + |
| 1908 | 95 + | 7 — | 15 — |
| 1909 | 171 + | 103 + | 34 + |
| 1910 | 264 + | 9 — | 13 — |
| 1911 | 78 — | 100 + | 100 + |
| 1912 | 47 — | 0 — | 10 — |
| 1913 | 207 + | 103 + | 114 + |
| 1914 | 0 — | 0 — | 0 — |
| 1915 | 549 + | 159 + | 114 + |

The results argue against any tendency in the individual trees towards alternate fruiting, as, if any such innate tendency existed, it would not be exhibited by different individuals in the same year : therefore in a plantation consisting of many individuals, even of the same variety, an average uniformity of production would result.

1292 – **Sources of Supply of Hazel-nuts.** — *Bulletin of the Imperial Institute*, Vol. XIV, No. 2, pp. 261-267. London, April-June 1916.

The various kinds of hazel-nuts are the produce of species of *Corylus*, a genus of shrubs or small trees native to the temperate parts of Europe, Asia and North America. The different kinds of nuts are distinguished by trade names according to their country of origin. A considerable quantity of hazel-nuts is produced in the United Kingdom, and supplementing this supply there is a large annual import derived chiefly from Spain, Italy and Asiatic Turkey. Hazel-nuts are not at present grown on a commercial scale in any of the British colonies. It is probable that hazel growing would succeed in parts of the Union of South Africa, British East Africa, Australia and Cyprus.

*United Kingdom.* — The hazel-nuts produced in this country are de-

rived from cultivated forms of *Corylus Avellana*, or hybrids between that species and *C. maxima*. They are grown chiefly in Kent. Generally speaking, varieties in which the leafy cups are shorter than the nuts are termed cob-nuts, whilst those with cups as long as or longer than, the nuts are termed filberts. The varieties most commonly met with among the cob nuts are Kentish Cob or Lambert Filbert, Merveille de Bollwyller, Pearson's Prolific and Berger; among the filberts, Red, White, Cosford, Frizzled. A yield of 100 tons of nuts has been frequently obtained from a plantation of 100 acres in Kent, whilst as high a yield as 2 ½ tons per acre was recorded for some localities in 1904. The value of hazel-nuts depends largely upon the size of the almond crops, for which they are used as a cheap substitute. The usual wholesale price is about 5*d*. per lb., but during the season 1915-1916 the prices ruled very high.

*Spain*. — In Spain the hazel-nut succeeds everywhere, but it is chiefly grown in the Catalan Provinces of Gerona and Tarragona. The nut bushes are usually grown in fields or gardens inter-cropped with other products. In Gerona the principal nut-growing area is the Selva, in the district of Santa Colonna de Farnés, whilst in Tarragona the crop is produced in the neighbourhood of the capital and at Tortosa and Montblanch. The light but moist soil of this area and the facilities for exporting these nuts have made nutgrowing a flourishing industry. The hazel-nuts imported into the United Kingdom from Spain are known on the market as Spanish and Barcelona nuts; the former are shipped from Gijon, a port in the Bay of Biscay, and the latter from Tarragona, a Mediterranean port. The Spanish nuts are grown in the Provinces of Galicia and Asturias, and are considered to be the produce of cultivated forms of *C. maxima*. The varieties chiefly grown are known locally as Mallorquina or Negreta de la Selva, a large nut with a hard reddish shell completely filled by the kernel, and Asturiana, which is a medium-sized or small nut produced in bunches of three or four.

The so-called Barcelona nuts, which are grown in Tarragona, are derived from *C. maxima* var. *barcelonensis*. The average yield is said to be about 55 lbs. of nuts per bush. As seen in commerce the nuts usually have a dark shell, which is due to their being kiln-dried in order to improve their keeping qualities. They are shipped from Tarragona in bags containing about 128 pounds each.

Of recent years there has been a demand for shelled nuts, which are shipped in bags weighing about 220 lbs. each. About half the entire crop has been exported in this condition, the principal importing countries being Germany, the United States, and the United Kingdom. The total annual crop of hazel-nuts produced in Spain is valued at over half a million sterling, whilst the quantity exported is valued at about £ 400 000.

*Italy*. — Large quantities of hazel-nuts are produced in South Italy, particularly in the province of Avellino. A considerable part of the crop is annually exported from Naples, chiefly to the United States, Germany, Holland, Austria-Ungary, France and the United Kingdom (arranged in order of importance). In 1909, 6 037 tons were exported from Naples and

in 1913 3777 tons. Of recent years Sicilian cob-nuts have attracted attention on the English market. These nuts are grown in woods at an elevation of more than 1 200 feet above sea level. The highest yield recorded for Sicily was in the year 1913, when the crop amounted to 13 000 tons. These nuts have been sent chiefly to Central Europe from the ports of Palermo and Messina in bags of 50 kilos. (110 lbs.) each. In 1913 1 068 metric tons of hazel-nuts were exported from Palermo and 945 British tons from Messina.

*Cyprus.* — In Cyprus the hazel-nut grows luxuriantly in the hill villages, and the nuts produced are of good size and fine appearance, They are gathered before they attain full maturity so that they soon become rancid. The exports are at present small, and the extension of the cultivation of this crop in Cyprus is urged.

*Asia Minor.* — The hazel-nuts obtained from Asia Minor are known as Turkish or Trebizond nuts, and in former times they were spoken of as Pontic hazels. They are the produce of *Corylus Colurna* a tree of moderate size, attaining a height of 60 to 80 ft. if allowed to develop fully. This species, or one or other of its geographical forms is distributed from South east Europe through Asia Minor and the Caucasus to the Himalayas and Western China. The cultivation of hazel-nuts for export is extensively carried on in the Black Sea coast region, from Khopa, on the Russian frontier, to Fatsa, which is just east of Unieh. Each tree produces annually from 16 to 24 lbs. of nuts, which are of three kinds: the round, the pointed, and the almond-shaped. The pointed are usually 10 per cent and the almond shaped 30 per cent dearer than the round nuts, which form about 70 per cent of the whole crop. The bulk of the round nuts are shelled before being shipped. The nuts are first sorted by revolving screens, then cracked by means of stone-mills, after which the kernels are dried in the sun and then packed in sacks for export. The shelling reduces the weight to half so that the freight charge is reduced by 50 per cent. 667 045 cwts. of hazel nuts were produced in the Trebizond Vilayet in 1913. The Kerassond is the chief district of production, its crop usually averaging from three-eighths to nearly five-eighths of the whole. The combined crops of Trebizond, Yomura, Off, Surmeneh, and Tazestan furnish between them from about one-quarter to three-eighths, whilst the remainder comes from the Tripoli Eleon, Ordu, and Sharli Fol districts in unequal proportions. Of the exports, about 48 per cent. have usually gone to Germany, 22 per cent. to Austria-Hungary, and about 14 per cent. to France and the United Kingdom. Exports to Russia have practically ceased, as nuts are successfully grown within Russian territory from Batum to Soukhoum Kaleh.

Hazel nuts are used as dessert-nuts, and also in the preparation of various nut foods and nut chocolate. They yield a bland golden-yellow oil which resembles almond oil, but has a lower iodine value.

The composition of fresh kernels of hazel (filbert) nuts is shown in the following table:

| | Hazel-nut kernels Per cent |
|---|---|
| Water | 48.0 |
| Crude proteins | 8.4 |
| Fat | 28.5 |
| Starch, etc. (by difference) | 11.1 |
| Fibre | 2.5 |
| Ash | 1.5 |
| Nutrient ratio | 1 : 9.12 |
| Foods units | 103.4 |

1293 - **Vine Growing at Benghazi, Tripoli.** — ZANON V., in *Giornale di Agricoltura della Domenica*, Year XXVI, No. 43, p. 347. Piacenza, October 22, 1916. VINE GROWING.

The region of Benghazi is very suitable in climate and soil for vine growing. The mean annual temperature does not exceed 68.7°F ; the range of temperature is the best for obtaining an early harvest (the ordinary grape ripens there at the end of June or the beginning of July), while the sharp changes of temperature in the spring do not interfere with the ripening of the fruit ; the annual rainfall is 18 inches. This precipitation is not sufficient to give a good harvest after a few years growth unless other water can be utilised, consequently the vineyards are only established in the neighbourhood of the ouadäi, the torrent which collects the rainfall from the mountain zone, and they are so placed that the water may be rapidly distributed. Under the local system of cultivation the shoots of the vines are wisely left to spread freely over the earth so that the gales do no damage. With the exception of a narrow sandy area which borders the district the soil is a red ferrugineous calcareous clay, the best that exists in Libya. As a rule the red soils of Benghazi are very rich in potash and phosphorus, they contain varying proportions of chalk in different localities and are always deficient in humus.

The vines are always kept low, and in gardens in inhabited areas they are even cradled in the ground. Two ditches, 30-36 inches deep and 20 inches wide are dug when planting and the earth is thrown up in the direction of the wind so as to form a shelter for the young plant which is thus well protected. Later on the earth is gradually levelled for greater convenience at the time of annual cultivation. Cuttings are always planted and 3-year old vines have shoots from 23 to 30 feet long.

Nearly all the varieties of vines grown in Benghazi and its environs are of Greek origin, chiefly from Candia. Six of them are thus described :

1) *White grape :* the earliest variety.

2) *White grape of Constantinople*, called Karidata by the Greeks : an excellent table grape.

3) *Black grape of Candia :* this is the most commonly grown vine in Benghazi and its environs ; very hardy, growth luxuriant, bunch winged, sometimes very large (up to 4 ½ to 6 ½ lbs.), with large berries (reaching 1 ¼ inch in diameter).

4) *Black grape :* much less luxuriant and productive than the preceding ; bunch elongated, usually simple.

5) *Black grape of Canea*, called Stafili Romeika by the Greeks: used for wine making.

6) *Red grape:* strong growing plant; bunch very large, winged, compact, but difficult to transport because of the watery pulp of the berries and the thinness of the skins.

It is probable that the method of cultivation could be improved by

1) spacing the rows at least 6 ½ feet apart.
2) deep working of the soil.
3) use of chemical manures.

It is useless to attempt to establish vineyards where the ouadai does not come, or to grow the plants on the system of training them above the level of the soil.

In addition to table grapes the colony produces sufficient wine for its own consumption.

## LIVE STOCK AND BREEDING.

HYGIENE OF LIVE STOCK

1294 – **The Immunisation of Cattle against Tuberculosis; Results of 10 Years' Trials Carried out at the Leipzig Veterinary Institute.** — EBER A., in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 78, No. 5, pp. 331-364. Jena, October 12, 1916.

In the spring of 1904 some large herds of cattle were vaccinated as a preventive measure against tuberculosis. The experiments were undertaken largely as a result of work done at the Veterinary Institute of Leipzig between 1902 and 1904 when, at the instigation of VON BEHRING, two animals were given a course of hypodermic and intravenous injections of vaccine and then tested for resistance to virus from an infected subject. They proved more resistant than untreated animals, so it was decided to extend the trials on a large scale using von Behring's « Bovovaccin » for the purpose. The following year another vaccine, « Tauruman », was tested, and in 1908 Klimmer's « Antiphymatol » was also used according to the methods of HEYMANS of Ghent.

Altogether 797 head of cattle were immunised during the 10 years' trials, while 169 animals were used as controls, and the experiments were distributed over 12 estates which represented different types of stock management in the Kingdom of Saxony, in Prussia and in the Duchy of Saxe-Altenberg. No fees of any kind were charged for vaccination but the owners of the herds were expected to give immediate notice of the death or slaughter of a treated subject, so that a careful post-mortem examination could be made. The total number of deaths and slaughterings notified amounted to 258 of which 39 were control animals. Whenever possible the post-mortem was carried out by the writer himself, failing which it was entrusted to a local veterinary surgeon who was given a special form on which to record his results.

Periodic tuberculin tests were also made both before and after vacci-

nation and throughout the experiment stress was laid less on the number of cases dealt with than on a careful study of the subjects actually treated.

It is pointed out that as in all other trials bearing on the propagation of tuberculosis, vaccination must be accompanied by prophylatic measures and must be carried out under strictly hygienic conditions. Consequently it is extremely difficult to distinguish between the effects of the vaccine and those due to the improved conditions of life. The experiments did not indicate that better results were obtained where vaccination was practised than when the treatment was confined to prophylactic measures alone. A special study was made of the efficiency of the Heymans vaccine. Though it cannot be denied that vaccines containing tubercle bacilli, such as "Heymans' capsules", have shown a certain curative effect on tuberculous subjects when used year after year, and have therefore tended to check the spread of the disease in a herd, their action is quite uncertain and frequently fails without any apparent reason. Except in very occasional cases, no permanent cure has been obtained, symptoms of the disease reappearing even in spite of repeated vaccinations. Further, in four herds which were only slightly infected, three of which were being treated with Heymans' vaccine and the other Antiphymatol, the result of vaccination was to make a latent form of tuberculosis of the udder suddenly active. On the whole it may be said that the curative effects of vaccination are not of an order to make it a reliable means of checking tuberculosis in cattle.

The trials were interrupted at the outbreak of the War.

1295 – **A New Parasite on Sheep Maggot Flies** (1). — FROGGATT W. W., in *Queensland Agricultural Journal*, Vol. VI, No. 3, pp. 177-179. Brisbane, September 1916.

At the Government Sheep-fly Experiment Station, Wooloondool, (near Hay), a new chalcid parasite (*Chalis calliphorae*) has been discovered by T. MCCARTHY on blowfly maggots (*Calliphora ocearíae*). It consists of a small black wasp, about the size of the common house fly and it lays a single egg in each maggot before the latter seeks cover to pupate. The new parasite is hardy, easy to breed and will stand a long journey by post in a packet.

*Nasonia brevicormis*, which is already know as a parasite of the blowfly maggot, is more prolific than *Chalcis calliphorae* and equally hardy, but it does not attack the maggots till after they have pupated.

1296 – **A New Unit for the Estimation of Food Values.** — SUCHTING H., in *Journal für Landwirtschaft*, Vol. 64, No. 3, pp. 163-170. Berlin, October 19, 1916.

FEEDS AND FEEDING

Kellner's "starch value" is a unit adopted for estimating and comparing the value of different foods and is estimated by converting all other substances in foods into terms of starch. This unit has been preferred to the "calorie" or energy unit for the practical reason that it is much larger and therefore simplifies calculations. The writer challenges the impracticability of the calorie and shows how it may be modified for use. Kellner always stated his starch values to a tenth of a kg. and with such a degree

(1) See also *B.* 1914, No. 1017; *R.* 1915, Nos. 401 and 1051.

of accuracy the equivalent calorie value certainly runs into large and unwieldy numbers ; but as the starch value of any one food is by no means constant and fluctuates to the extent of anything between 10 and 100 per cent according to the nature of the food, it would seem quite unnecessary to go into decimals of starch values. The writer proposes that a unit of 1 000 calories be adopted in the place of starch values (and decimals of starch value) and points out that even this unit is too small as 1 000 calories are equivalent to 0.25 kg. of starch. He considers this new unit to be more practical, simpler and more exact than starch values. From the physiological point of view too, it is more satisfactory to compare the animal body to an engine supplied with fuel and to obtain the food value in terms of the fuel, which can then be easily be converted into force, than to obtain the food value in terms of one of the substances in the food.

The value of digestible food substances would thus be expressed in heat units or large calories for which the name of " Kellner values " is proposed, and 1 kg. of starch, protein and fat would be equivalent to 4,4 and 9 Kellner values respectively. For example the Kellner value of 100 kgs. of wheat (95 per cent digestible) containing 9 per cent of protein, 1 per cent of fat and 64 per cent of nitrogen free extract would be :

| | | |
|---|---|---|
| 9 kgs. | protein . . . . . | = 9 × 4 = 36 |
| 1 " | fat . . . . . | = 1 × 9 = 9 |
| 64 " | N-free extract . . | = 64 × 4 = 256 |
| | Total . . . . | = 301 |

$$\text{or } \frac{300 \times 95}{100} = 285 \text{ Kellner values.}$$

HORSES

1297 – **The Horse-Breeding Industry in Saskatchewan.** — *The Agricultural Gazette of Canada.* Vol. 3, No. 8, pp. 705. Ottawa, August 1916.

The development of the horse breeding industry in Saskatchewan, in the last 15 years, has been a considerable one, as indicated by the following figures, in which those for 1881 and 1891 are for Alberta and Saskatchewan combined :

| Year | Numbers of horses |
|---|---|
| 1881 . . . . . | 10 870 |
| 1891 . . . . . | 60 976 |
| 1901 . . . . . | 83 801 |
| 1911 . . . . . | 507 468 |
| 1915 . . . . . | 667 443 |

At an early date some of the horse ranches began the use of draft stallions for breeding, purposes, although most of them used thorough bred sires and raised a lighter type of animal. At present the use of sires of the draft breeds is the rule rather than the exception as the accompanying enrolment figures for 1916 indicate :

| | |
|---|---|
| Clydesdale | 1868 |
| Percheron | 670 |
| Shire | 68 |
| Standard Bred | 189 |
| Hackney | 52 |
| Throughbred | 27 |
| French Canadian | 1 |
| French Coach | 3 |
| German Coach | 7 |
| Suffolk | 36 |
| Belgian Draft | 126 |
| Saddle Horse | 6 |
| Shetland Pony | 1 |
| Morgan | 1 |
| Jack | 1 |
| Total pure breds | 3 056 |
| Grades | 606 |
| Crossbreds | 2 |
| Scrubs | 584 |
| Total | 4 248 |

Advanced legislation with respect to horse breeding provides for the annual enrolment of all stallions used for breeding purposes and the examination and licensing of all stallions used for service in municipalities included in the Licensed stallion District.

Saskatchewan Clydesdale are famous throughout Canada as representative of the best development, of this famous breed and show ring champions both male and female are owned by Saskatchewan breeders.

1298 – **Gestation and Sterility in Cows.** — STALFORS H., in *Monatschefte für praktische Tierheilkunde*, Vol. 27, No. 7-8, pp. 338-358. Stuttgart, May 27, 1916. CATTLE

I. *Studies on gestation.* — During the years 1907 to 1915 a large number of in-calf cows were examined for the purpose of determining in which horn of the uterus the fœtus was carried. The examinations were made per rectum some time between the sixth and fifteenth week of gestation, that period being the most favourable for the operation; fluctuation, asymmetry and an increase in size of the uterus were taken as symptoms of pregnancy. With at least half the animals under experiment the ovaries were also examined for corpora lutea though no records were kept of the observations.

Out of a total of 923 cows examined, 577 cows or 62.5 per cent of the cases carried the fœtus in the right horn of the womb, and 346 in the left horn, proportions which are approximately those found by other workers. With 105 of the cows, the animals were kept under observation for two successive periods of gestation and in 62 of the cases the fœtus was twice carried in the same horn, indicating that the one ovary was rather more productive than the other. The greater productivity of the right ovary with respect to the left is attributed to the pressure exerted by the paunch on the nerves and blood vessels of the left side as well as on the left ovary itself.

It was observed that the fertilised ovum frequently began its development in the body of the uterus rather than in the horn and only passed definitely into the horn at a later stage. This fact has been denied by many investigators, but in the present experiments considerable development and fluctuation was noted in the body of the uterus between the fourth and sixth weeks of gestation, whilst the horns remained about the same size.

II. *Influence of handling on the productiveness of ovaries.* — From 1910 to 1915 six herds containing from 12 to 100 cows each were kept under special observation being visited every 4 to 8 weeks and any barren animals were subjected to an operation on the ovaries. This consisted in an exploration per rectum and of a squeezing or crushing of corpora lutea or cysts which might have persisted in the ovaries. The uterine catarrh resulting from the operation was treated at the same time by vaginal injections. Out of 264 cows so treated more than half became normally productive again.

It is quite evident from the results of the experiments that the function of the ovaries was not interfered with by the handling, on the contrary it appeared to make them more productive. In 146 out of 211 cases of pregnancy after treatment (59.2 per cent) it was possible to trace the fertilized ovum to the ovary which had been treated. A number of these pregnant cows were maintained under observation and out of a total of 133, 81 or 60.9 per cent proved to have become absolutely normal again including a case of uterine catarrh independent of the ovaries. And of these normal pregnant cows, in 63 out of 77 cases (81.8 per cent) the fertilized ovum was traced to the treated ovary.

*Conclusions.* — In the cow the fœtus is borne in the right horn of the uterus more frequently than in the left, the frequencies being as 64 to 36.

The treatment of the ovaries by handling, if not carried out too violently, exerts no depressing, debilitating or deleterious action on the sexual functions or on the productivity of the ovaries. It may on the contrary reestablish and increase the functions of the ovary when the latter have been interfered with by such things as the persistence of corpora lutea or cysts in the ovary.

1299 – **The Advantages of Winter Calving.** — Gouin A., in *Comptes Rendus de l'Académie d'Agriculture de France*, Vol. II, No. 33, pp. 972-973. Paris, October 25, 1916.

Winter calves are often considered unsatisfactory, being looked upon as delicate and unsuitable for breeding stock. The writer brings forward his own experience which is in contradiction to these views. Between 1895 and 1913 he bred and raised 127 yearlings, chiefly heifers, of which 39 were born during the months of October to January and 88 from February to September. At twelve months the average weight of the winter calves was 561 lbs. and that of the spring and summer calves 600 lbs. Of the 127 yearlings, 60 were eventually brought into the milking herd and their weights three months before calving were 113 lbs. for the 20 born in winter while the other 40 only averaged 2 lbs. more.

The season of birth would therefore seem to have no influence on the

ultimate development of the animals, and where artificial rearing is practised winter calving is certainly more economical, for by feeding skim milk and a fat substitute the calves got on very well till the spring when they were old enough to take full advantage of the grass ; and when they were brought in the following winter, the winter calves had a big start over the summer ones and were able to be put at once on to a more economical ration.

1300 - ***Capra prisca* an Unknown and Extinct Race of the European Domesticated Goat.** — ADAMETZ, in *Mitteilungen der landw. Lehrkanzeln der K. K. Hochschule für Bodenkultur in Wien*, Vol. 3, No. 1, pp. 1-21. Vienna, 1915. GOATS

In 1913, a portion of fairly well preserved skull belonging to a fossil goat was received for examination from Prof. ED. VON LUBICZ VIERZATITOWSKI. It had been found together with two other similar skulls and the remains of a horse's skull when laying a water main at Iloczow in Eastern Galicia, at a depth of 15 ft. from the surface. A careful study of the skull showed that it belonged to a well defined extinct species of wild goat which was given the name of *Capri prisca* n. sp.

Up to the present it has been considered that the different varieties of the European domesticated goat are all descended from a common ancestor which is still represented by the Bezoar wild goat (*C. aegagrus*) ; and the fact that the position and conformation of the horns and rudimentary horns in the domesticated goats differ markedly from those of the wild goat has been attributed to somatic variation or mutation. When the skulls of *C. aegagrus* and of its sub-species the Cretan goat (*C. aegagrus cretensis*) and the wild goat of the Island of Erimomilos (*C. aegagrus pictus*) were compared with the skull of *C. prisca* the conformation of the chief bones was found to be different. But on the other hand the conformation of the skull of *C. prisca* was absolutely identical with that of the so-called Jura wild goat (*C. dorcas* Reichw. or *C. hircus dorcas* according to DE LORENZ-LIBURNAU who proved it to be merely a goat reverted to the wild state), and very similar to that of the majority of the European domesticated breeds, in particular the goats of Bosnia-Herzegovina, of Serbia and of Albania.

It would therefore seem that the hypothesis of the Bezoar goat as sole ancestor of the European domesticated breeds is untenable, as most of the latter are more probably derived from *C. prisca*. Some breeds however, such as for instance the old Alpine breed of Salzburg, are just as clearly related to *C. aegagrus*.

The writer is proceeding with a thorough examination of all available prehistoric material in the light of this latest discovery.

1301 - **Fish Meal as Food for Pigs.** — CROWTHER C., in *The Journal of the Board of Agriculture*, Vol. XXIII, No. 1, pp. 27-33. London, April 1916. PIGS

At the Experimental Farm of the University of Leeds (Garforth) feeding trials were carried out to test the value of fish meal as food for pigs. Twelve large white pigs ranging in age from 13 to 21 weeks were divided into two lots as evenly as possible, each lot consisting of 3 castrated hogs

TABLE I. — *Plan of experiment.*

| Period | General character of feeding | Average daily ration per lot of 6 pigs | | |
|---|---|---|---|---|
| | | Lot *A* | | Lot *B* |
| | | | Lbs. | Lbs. |
| Preliminary control 4 weeks June 15 to July 13 | Identical for both lots. No fish meal. | Bran | 2.4 | 2.4 |
| | | Sharps | 12.0 | 12.0 |
| | | Water | 72 | 72 |
| First transitional 1 week July 14 to 20 | Fish meal gradually introduced into ration of lot *A* in place of equal weight of sharps. | Bran | 3.0 | 3 |
| | | Sharps | 13.5 | 15 |
| | | Fish meal | 1.5 | — |
| | | Water | 90 | 90 |
| First experimental 6 weeks July 21 to August 31 | Lot *A*: bran, sharps, fish meal. Lot *B*: bran, sharps. | Bran | 4.1 | 4.1 |
| | | Sharps | 18.1 | 20.8 |
| | | Fish meal | 2.7 | — |
| | | Water | 107 | 107 |
| Second transitional 1 week September 1 to 7 | Rations gradually transposed. | Bran | 5.8 | 5.8 |
| | | Sharps | 27.5 | 25.3 |
| | | Fish meal | 1.4 | 3.6 |
| | | Water | 139 | 139 |
| Second experimental 6 weeks Sept. 8 to October 19 | Lot *A*: bran, sharps. Lot *B*: bran, sharps, fish meal. | Bran | 6.5 | 6.5 |
| | | Sharps | 32.5 | 27.1 |
| | | Fish meal | — | 5.4 |
| | | Water | 146 | 146 |
| Third transitional 1 week October 20 to 26 | Fish meal gradually introduced into ration of lot *A*. Ration of lot *B* unchanged. | Bran | 8 | 8 |
| | | Sharps | 36 | 33 |
| | | Fish meal | 4 | 7 |
| | | Water | 160 | 160 |
| Final control 3 weeks Oct. 27 to Nov. 17 | Identical for both lots. Fish meal included in ration. | Bran | 9.8 | 9.8 |
| | | Sharps | 42.2 | 42.2 |
| | | Fish meal | 7.0 | 7.0 |
| | | Water | 182 | 182 |

and 3 gilts. The experiment began on June 15, 1915 and lasted 22 weeks. For the first 4 weeks each lot was given the same ration of bran and sharps. Fish meal was then gradually introduced into the ration of lot A in the place of an equal weight of sharps. Seven weeks later the rations were gradually transposed, the fish meal being gradually replaced by sharps in the ration of Lot A and introduced in the place of sharps in the ration of

TABLE II. — *Composition of fish meal*

| | Meal used in experiment | Average of 7 samples |
|---|---|---|
| | per cent | per cent |
| Moisture | 4.6 | 12.9 |
| Protein | 52.7 | 55.8 |
| Oil | 6.7 | 3.8 |
| Ash, including | 25.3 | 25.3 |
| Phosphoric acid | 9.5 | 8.6 |
| Chorides expressed as Nacl | 2.6 | 2.2 |

TABLE III. — *Average weekly gain in live weight per pig.*

| Period | Lot *A* | | | Lot *B* | | |
|---|---|---|---|---|---|---|
| | Hogs | Gilts | Average | Hogs | Gilts | Average |
| | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. | Lbs. |
| Preliminary control | 5.3 | 5.5 | 5.4 | 4.8 | 5.2 | 5.0 |
| First experimental | 11.0 | 10.6 | 10.8 | 8.3 | 10.8 | 9.5 |
| Second » | 10.3 | 9.0 | 9.7 | 11.5 | 10.6 | 11.1 |
| Final control | 15.4 | 12.0 | 13.7 | 12.5 | 11.1 | 11.8 (1) |

(1) This average is depressed by the abnormally low gain recorded in the last week when 2 gilts, being *in oestro*, not only failed to gain in weight, but caused general disturbance of the whole lot. The average for the preceding 2 weeks were: Lot *A*, 14.4 lbs.; Lot *B*, 14.7 lbs.

Lot B. Seven weeks later again fish meal was once more substituted for an equal weight of sharps in the ration of Lot A, but was not removed from the ration of Lot B, so that for the last 4 weeks each lot received fish meal along with the bran and sharps and for the last 3 weeks the rations were identical in every respct. The general plan of the experiment is summarised in Table I.

The composition of the fish meal used is given in Table II, average gains in live weight are summarised in Table III, and in Table IV are set out the quantity of foodstuffs consumed and the average cost of the rations based on the following prices per ton:

| | £ | s | d |
|---|---|---|---|
| Bran | 6 | 16 | 4 |
| Sharps | 9 | 12 | 6 |
| Fish meal | 10 | 10 | 0 |

Fish meal as compared with sharps effected an extra gain in live weight of 1.3 lb. per pig per week on the average of the first experimental

TABLE IV. — *Average amount and cost of weekly ration per pig.*

| | Lot *A* | | Lot *B* | |
|---|---|---|---|---|
| | Weight | Cost | Weight | Cost |
| | lbs. | *d* | lbs. | *d* |
| *First experimental period.* | | | | |
| Bran | 4.8 | 3.50 | 4.8 | 3.50 |
| Sharps | 21.1 | 21.73 | 24.2 | 24.92 |
| Fish meal | 3.1 | 3.49 | — | — |
| *Total* | 29.0 | 28.72 | 29.0 | 28.43 |
| *Second experimental period.* | | | | |
| Bran | 7.6 | 5.55 | 7.6 | 5.55 |
| Sharps | 37.9 | 39.04 | 31.6 | 32.55 |
| Fish meal | — | — | 6.3 | 7.09 |
| *Total* | 45.5 | 44.59 | 45.5 | 45.19 |

| | With fish meal | | Without fish meal | |
|---|---|---|---|---|
| | Weight | Cost | Weight | Cost |
| | lbs. | *d* | lbs. | *d* |
| *The two periods combined.* | | | | |
| Bran | 6,2 | 4.53 | 6.2 | 4.53 |
| Sharps | 26.35 | 27.14 | 31.05 | 31.98 |
| Fish meal | 4.7 | 5.29 | — | — |
| *Total* | 37.25 | 36.96 | 37.25 | 36.51 |

period and of 1.4 lb. per pig per week on the average of the second experimental period or an average gain for the whole period of 1.35 lb. weekly. On the other hand the use of fish meal to the extent of one eighth of the total ration as a substitute for an equal weight of sharps increased the cost of feeding by barely ½ *d* per pig per week. If, further, the residual manurial values be allowed on the scale suggested by Hall and Voelcker, the fish meal becomes actually cheaper since the manurial value of the fish meal is £ 4 8*s* per ton, whilst that of the sharps is but £ 1 9*s* per ton. But even leaving out of account the manurial value and considering only the live weight gains, there can be no doubt as to the decided benefit of partially replacing sharps by fish meal.

No objectional taint was imparted to the carcass of the animal by the use of fish meal.

1302 – **Poultry Breeding in Tunis; Imported and Native Breeds.** — CHENEVARD W.. in *Bulletin de la Société d'Horticulture de Tunisie*, Year 14, No. 99, pp. 157-160. Tunis, October 15, 1916. POULTRY

" Kabyles " is the term commonly used for all native poultry in Tunis, but for practical purposes the three following classes may be distinguished :

1) The true Kabyle, generally partridge colour with a long body, yellow legs and a weight which rarely goes above 2 lbs.

2) The Arab type which is rather a better kind of bird, more compact in form, with yellow or green legs and various colourings of plumage, generally tending towards a yellow brown ; its average weight is 2.2 to 2.6 lbs.

3) All other birds.

Good results have been obtained with the Arab by selection and by crossing with imported varieties, birds weighing up to 3 to 4.5 lbs. being obtained, but the quality of the flesh is very poor. Kabyles are too small ever to prove of economic importance.

An experiment was carried out in which the weights of birds of the Arab type were compared with those of a Malines cross known as the Tunisian Cuckoo throughout the period of their growth. The mean figures are given below.

| | Weight of egg or chick | | | |
|---|---|---|---|---|
| | Tunisian Cuckoo | | Arab | |
| | oz. | | oz. | |
| Egg before incubation | 2.07 | | 1.75 | |
| " after 5 days incubation | 1.96 | | 1.65 | |
| " " 10 " " | 1.86 | | 1.58 | |
| " " 15 " " | 1.75 | | 1.47 | |
| " " 21-22 " chick 1.40 | 1.65 | | 1.26 | 1.40 |
| shell 0.25 | | | 0.14 | |
| Loss of weight during incubation | 0.42 | | 0.35 | |
| Chick 3 days old | 1.30 | | 1.12 | |
| " 5 " " | 1.50 | | 1.26 | |
| " 10 " " | 1.75 | | 1.30 | |
| " 15 " " | 2.07 | | 1.43 | |
| " 20 " " | 2.63 | | 1.68 | |
| " 25 " " | 3.53 | | 2.07 | |
| " 30 " " | 5.53 | | 2.98 | |
| " 45 " " | 12.60 | | 5.75 | |
| " 60 " " | 21.70 | | 9.59 | |
| " 75 " " | 30.40 | | 13.13 | |
| " 90 " " | 44.10 | | 18.38 | |
| " 105 " " | 59.50 or 3 3/4 lbs. | | 24.68 or 1 1/2 lb. | |

The feeding consisted of hard egg and bread sop to start with, followed by barley mash, cooked rice and sour milk together with millet and tail corn, the consumption per head up to 105 days old and per lb. of live weight being as follows :

| | Tunisian Cuckoo | | Arab | |
|---|---|---|---|---|
| | Per head lbs. | Per lb. live weight lbs. | Per head lbs. | Per lb. live weight lbs. |
| Dry matter | 21.6 | 5.8 | 9.16 | 5.9 |
| Digestible protein | 2.9 | 0.8 | 1.3 | 0.9 |
| " fat | 1.5 | 0.4 | 0.7 | 0.5 |
| " carbohydrates | 12.7 | 3.4 | 5.8 | 3.7 |
| Cellulose | 0.5 | 0.1 | 2.0 | 0.1 |
| Starch value | 16.1 | 4.3 | 7.4 | 4.8 |

The Arab birds required about 10 per cent more food than the Tunisian Cuckoo.

1303 – **Fecundity in Relation to Stamina.** — DUNNIGLIFF (Jun.) A. A., in *The Agricultural Gazette of New South Wales*, Vol. XXVII, No. 7, pp. 507-510, Sydney, July 1916.

The danger signal has been raised by more or less authoritative critics in various parts of the world that striving for higher and higher egg production, and the breeding from hens of great fecundity, can only result in degeneration of the constitution of the stock and consequent disaster to the breeder. Egg laying competitions have been pointed out as exercising a dangerous influence in this direction. In New South Wales however where these competitions have been in progress longer than in any other part ot the world there is no evidence of loss of stamina in very prolific birds. The attainments of high records in this country has never been subordinated to practical and utilitarian considerations, restrictions having always existed with regard to quality, size of eggs, and weight of pullets

It is instructive to trace the results of breeding from hens that have put up high records in competitions. For instance, the pen of White Leghorns which won the second two-years' test with 1474 and 1150 eggs in the first and second years respectively and the pen which won the fourth two-years' test with 1324 and 1045 eggs both belonged to the same owner and proved entirely satisfactory as breeders both as regards fertility and constitutional vigour of the progeny. Another example is the White Leghorn hens which won the 1912-1913 competition with 1461 eggs and which were used later with other birds of the same stock in the single pen test of 1914-1915 when they achieved a world's record. The four best hens in that group had individual records of 267, 270, 270,288 eggs, yet when used afterwards for breeding, they gave no evidence of having suffered constitutionally from the strain of the great production.

The available evidence warrants the conclusion that a hen is not to be regarded as a doubtful transmitter of stamina to her progeny because she is the possessor of the faculty of fecundity in a high degree. The 200 egg hen has now become a commonplace in Australia and there seems no reason why it should not be eventually replaced by strains producing 250 eggs or even more.

FISH CULTURE.

1304 – **The Distribution of Fish and Fish Eggs during the Fiscal Year Ending 1915.** — JOHNSON R. S., *Department of Commerce, Bureau of Fisheries, Document* No. 828, pp. 1-138. Washington, D. C., 1916.

During the fiscal year 1914-1915 the breeding establishment of the U.S. Bureau of Fisheries bred and distributed about fifty species of fresh-

*Number of eggs, small fry and small fish distributed by the U. S. Bureau of Fischeries during the fiscal year* 1914-1915.

| | Eggs | Small fry | Small fish, one year old fish, full grown fish | Total |
|---|---|---|---|---|
| *Ameiurus* spp. | — | — | 1 665 793 | 1 665 793 |
| *Cyprinus carpio* | — | — | 644 411 | 644 411 |
| *Catostomus commersoni* | — | — | 200 | 200 |
| *Ictiobus* spp. | — | — | 114 849 | 114 849 |
| *Aplodinotus grunniens* | — | — | 65 | 65 |
| *Alosa sapidissima* | — | 46 009 595 | — | 46 009 595 |
| *Clupea* spp. | — | 4 851 000 | — | 4 851 000 |
| *Coregonus albus* and *C. clupeaformis* | 98 900 000 | 405 400 000 | — | 504 300 000 |
| *Leucichthys artedi* | — | 92 350 000 | — | 92 350 000 |
| *Onchorhynchus kisutch* | 1 948 280 | 21 204 230 | 2 756 062 | 25 908 572 |
| *Oncorhynchus tschawytscha* | 34 466 723 | 44 554 892 | 16 741 450 | 95 763 065 |
| *Oncorhynchus nerka* | 3 155 000 | 43 776 741 | 8 666 255 | 55 597 996 |
| *Oncorhynchus gorbuscha* | — | 11 758 500 | 479 037 | 12 237 537 |
| *Oncorhynchus keta* | — | 35 504 707 | — | 35 504 707 |
| *Salmo gairdneri* | 634 000 | 2 259 113 | 3 244 660 | 6 137 773 |
| *Salmo irideus* | 2 022 990 | 568 930 | 2 144 875 | 4 736 795 |
| *Salmo salar* | — | 1 804 313 | — | 1 804 313 |
| *Salmo sebago* | 291 000 | 310 042 | 140 015 | 741 057 |
| *Salmo trutta* | — | 58 430 | — | 58 430 |
| *Salmo henshawi* | 3 435 000 | 1 939 250 | 4 784 067 | 10 158 317 |
| *Salmo trutta levensis* | — | — | 48 000 | 48 000 |
| *Cristivomer namaycush* | 12 850 000 | 35 294 000 | 3 093 723 | 51 238 468 |
| *Salvelinus fontinalis* | 507 150 | 5 700 263 | 6 965 167 | 13 172 580 |
| *Osmerus mordax* | 14 500 000 | 6 900 000 | — | 21 400 000 |
| *Thymallus montanus* | 350 000 | 1 873 000 | — | 2 223 000 |
| *Pomoxis annularis* | — | — | 1 800 430 | 1 800 430 |
| *Pomoxis sparoides* | — | — | 470 | 470 |
| *Ambloplites rupestris* | — | — | 414 078 | 414 078 |
| *Micropterus dolomieu* | — | 653 170 | 81 177 | 734 347 |
| *Micropterus salmoides* | — | 758 300 | 1 431 850 | 2 190 150 |
| *Lepomis pallidus* | — | 135 000 | 2 799 766 | 2 934 766 |
| *Esox lucius* and *E. reticulatus* | — | — | 87 846 | 87 846 |
| *Stizostedion vitreum* | 326 350 000 | 282 820 000 | 383 | 609 170 383 |
| *Perca flavescens* | 19 000 000 | 195 267 000 | 104 287 | 214 371 287 |
| *Roccus lineatus* | — | 8 594 500 | — | 8 544 500 |
| *Morone americana* | 17 850 000 | 161 980 000 | — | 179 830 000 |
| *Roccus chrysops* | — | — | 2 825 | 2 825 |
| *Morone interrupta* | — | — | 420 | 420 |
| *Gadus callarias* | — | 260 133 000 | — | 260 133 000 |
| *Pollachius virens* | — | 500 730 000 | — | 500 730 000 |
| *Scomber scombrus* | — | 4 847 000 | — | 4 847 000 |
| *Melanogrammus æglifinus* | — | 26 814 000 | — | 26 814 000 |
| *Pseudopleuronectes americanus* | — | 1 294 156 000 | — | 1 294 156 000 |
| *Tautoga onitis* | — | 606 000 | — | 606 000 |
| *Homarus americanus* | — | 194 670 000 | 3 779 | 194 673 779 |
| Totals | 536 260 143 | 3 694 281 699 | 58 215 962 | 4 288 757 804 |

water fish excluding the nacreous shell fish (*Lampsilis ventricosa, L. ligamenta, L. luteola, L. recta, L. anodontoides, Plagiola securis, Quadrupla pustulosa*) and the American crayfish (*Homarus americanus*). Other species were captured during a flood in the basin of the Mississippi and replaced in their respective rivers after the flood had subsided.

The adjoining Table shown the amount of restocking actually accomplished. " Small fry " is used to designate newly born fish, and " small fish " are those about the size of a finger.

VARIOUS

1305 - **Feeding Experiments with Rabbits.** — DAVIES C. J., in *The Journal of the Board of Agriculture*, Vol. XXIII, No. 6, pp. 583-585, London, September 1916.

In order to obtain precise details of the relative merits of various concentrated foods, of the total amount of food consumed and of the cost of rearing, 8 rabbits of similar breed, belonging to two litters of about the same age, were experimentally fed for 6 weeks in the summer of 1916. The results of the experiments are given in Tables I and II.

TABLE I. — *Daily ration of each pair of rabbits.*

| | Age of rabbits in weeks | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| | oz. | oz. | oz. | oz. | oz. | oz. |
| Concentrated food . . . . . | 1 | 1 | 1 | 1.5 | 2 | 2 |
| Clover hay . . . . . | 1 | 1 | 1 | 1 | 1 | 1 |
| Green stuff . . . . . | 10 | 14 | 16 | 16 | 16 | 16 |

TABLE II. — *Cost of concentrated food and live weight increase.*

| Lot | Concentrated food | Content of: | | Cost of food per lb. (1) | Total cost of concentrated food per head | Average Liveweight increase per head |
|---|---|---|---|---|---|---|
| | | Protein | Oil | | | |
| | | Per cent | Per cent | *d* | *d* | lb. oz. |
| 1 | Bran . . . . . | 14 | 4 | 1 | 2 | 1 9 |
| 2 | Oats. . . . . | 12 | 6 | 2 | 4 | 1 10 |
| 3 | Bran, 2 parts . . . . . | | | | | |
| | Oat meal, 1 part. . . . | 18 | 6 | 1.5 | 3 | 1 10 |
| | Dairy cake, 1 part . . . | | | | | |
| 4 | Dairy cake. . . . . | 24 | 6 | 1.5 | 3 | 1 3 |

(1) Maximum prices for food bought locally in small quantities.

All rabbits received water to drink and a lump of rock salt to lick, also a daily allowance of clover hay and freshly cut green stuff. The pair fed on dairy cake (Lot 4) gave poor results which were due partly to the

fact that one rabbit disliked it and seldom ate her share. At the end of of the experiment Lot 3 carried the most flesh and the mixture they received was used successfully throughout the year, giving support to the view that a mixture of foods is better than single foods.

The experiments show that oats can be very well replaced by cheaper foods and that rabbits can be reared for the 6 weeks of their greatest growth in summer at a cost of ½*d* per week for concentrated food. Roughly speaking it was found that it took some 15 lbs. of food to produce 1 lb. increase live weight and this figure agrees very well with the observations made by the writer many years ago when it was estimated that each rabbit increased 1 lb. for every 12 lbs. of food consumed. During the 6 weeks experimental period each rabbit produced 9 to 10 lbs. of dry and liquid manure.

## FARM ENGINEERING.

AGRICULTURAL MACHINERY AND IMPLEMENTS

1306 – **New Dressing Machine for Spherical Grain.** — *Illustrierte landwirtschaftli he Zeitung*, 36th Year, No. 64, pp. 429-430. Berlin, August 9, 1916.

In plate dressing machines of the usual type, seeds which are not perfectly round or those having flat surfaces on them, either stay on the plate or move along very slowly and leave it reluctantly. This causes seeds of inferior quality to fall into the hopper.

On the other hand, in the new machine described here, (made by ERNST LÖSCHE at Koenigsberg, Prussia; German Patent No. 292 667), a step device causes the seeds to make a kind of jump which allows them to roll and to leave the plate at the proper moment. Again, the fact that the external ring of the plate is adjustable, allows the individual characteristics of each kind of seed to be provided for and gives most efficient separation. Another novelty consists in the adjustability of the carrier platforms situated in the annular discharge channels. In this way the classification of the different kinds of grain can be varied at will. Finally the rousing shaft fixed in the feed channel is a very useful improvement; it keeps the grain in constant motion and prevents the formation of heaps. The friction rids the grain of husks, stalks, etc., while sand and other impurities are led to a sieve at the bottom of the feed channel and thus do not reach the dressing plates. Fig. 1 shows a complete view of the machine; fig. 2 a horizontal section at *A B*; fig. 3 a portion of the annular channel with the carrier platform *p* controlled through the window *O*; and fig. 4. is a vertical section of a dressing plate and feed channel, showing also the under side of a dressing plate with adjusting wing-nuts *t*; the position of the rousing shaft *h* is indicated together with its driving-bevel *e*.

As shown in fig. 1, the three pillars *a* of the frame function also as discharge channels and are connected by the cross-piece *h*. The frame carries the cylindrical feed channel *c* which at its upper end has a driving-bevel *e*, running on a ball-bearing *d*. From this bevel the dressing plates *f* are suspended by stay-bolts. The shaft *h* forms the axis of the bevel *e*. It is

*New dressing machine for spherical grain.*

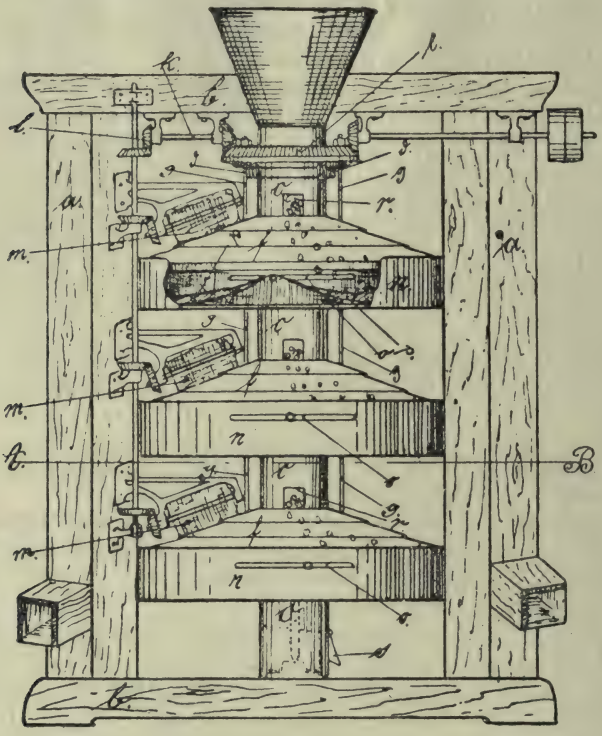



Fig. 1. Complete machine.

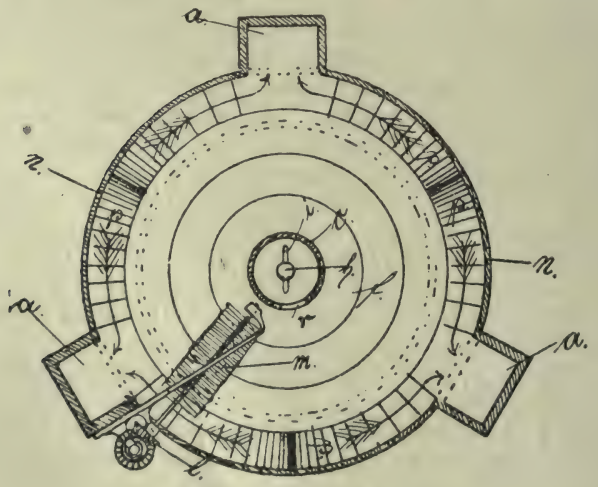



Fig. 2. Horizontal section at *A B*.

furnished with rousing fingers and the lower end runs on a step-bearing at the bottom of the feed-channel (as indicated in fig. 1). The bevel *e*, which is driven by any suitable power, drives a series of brushes *m* by means of the shaft *k* and the bevel-gears *l*. The pillars *a* are connected with the annular channels *n* in which the platforms *p* are situated. The latter are regulated through the slots *o* and carry the dressed grain in the pillars to the internal discharge channel.

*New dressing machine for spherical grain.*

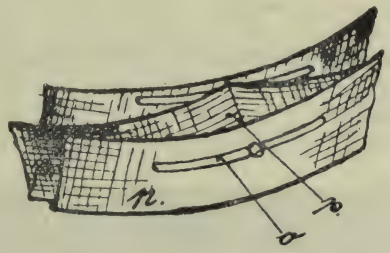


Fig. 3. — A portion of the annular channel with the carrier platform *p*. controlled through the window *o*.

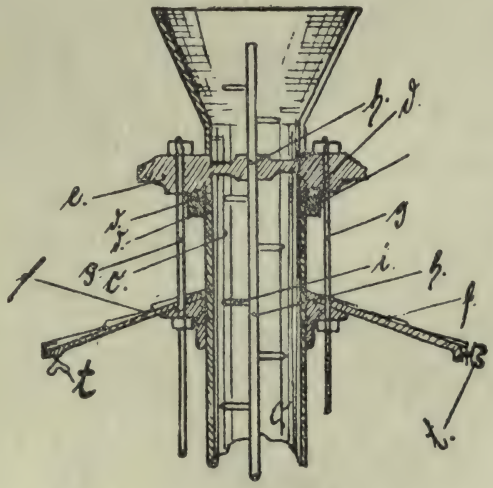


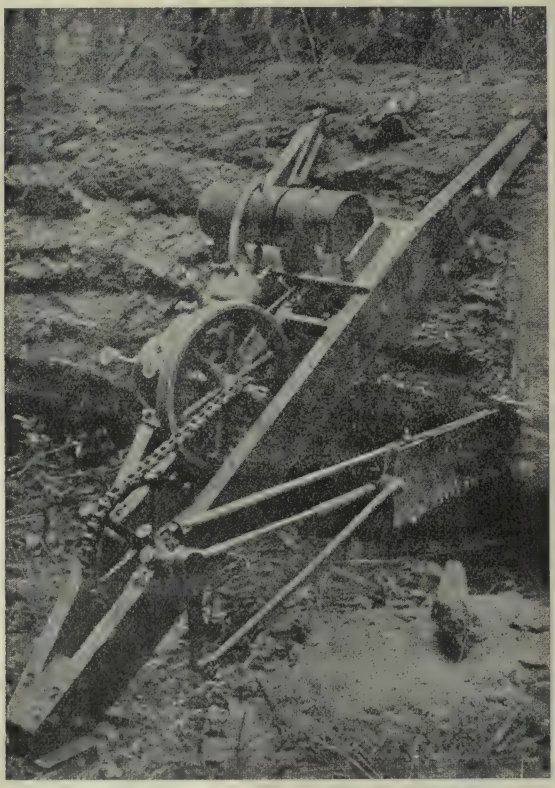
Fig. 4. — Vertical section of a dressing plate and feed channel.

*Mode of action.* — The dressing plates are put in motion by any suitable power. The grain to be dressed is introduced to the cylindrical feed channel *c* through a funnel or by similar means. Hence it passes to the plates by discharge orifices *r* under the influence of the rousing shaft *h*. The seeds roll over the dressing plates *t* which surround the channel *c* and

move quickly or slowly, according to their weight and shape, towards the channels *n* at the periphery of the plates. Perfectly round seeds roll quickly off the plate and reach the annular channel on the first carrier platform *p* and thence the first discharge channel. Seeds which are not round or those which are gnawed by worms roll slowly to the edge of the plate and only reach the second division of the annular channel passing out though the corresponding discharge orifice. Broken or damaged grain, husks, etc., slip rather than roll and only reach the third division and emerge by the last discharge opening. Debris (stalks, etc.), entangled in the grain, which is not carried to the sieve by the rousing shaft, is removed from the plates by the rotary brushes *m*.

1307 – **The Elbert Vaughan Portable Saw driven by Petrol Motor, for Tree Felling** (1). — *The Scientific American*, Vol. CXV, No. 11, p. 264. New York, September 1916.

The Elbert Vaughan portable saw is driven by a 3.5 HP, two-stroke petrol motor. The total weight of the machine is about 220 lbs. As shown



The Elbert Vaughan portable motor saw.

(1) See also *B.* May 1916, No. 550. (*Ed.*).

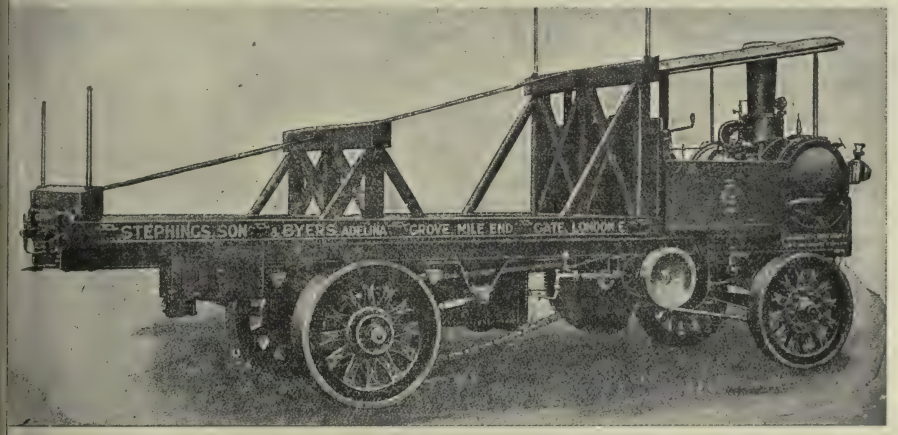
in the attached figure, the saw is mounted on a V-shaped frame of which the lower end rests on the ground while two clamps fix it solidly to the tree to be sawn. When a cut is finished the machine can be shifted by two men to the place where the next cut is to be made.

As an example of the work done by this portable saw in 10 hours, the writer gives :

| | | |
|---|---|---|
| *Maximum* . . . . . | 35 cords (4480 cub. ft.) | of wood in billets of 4 feet. |
| *Minimum* . . . . . | 15 cords (1907 cub. ft.) | » » » |
| *Averag* . . . . . | 20 cords (2546 cub. ft.) | » » » |

1308 – **Lorry for Transporting Timber in Long Lengths.** — *The Implements and Machinery Review*, Vol. 42, No. 498, p. 663. London, 1916.

The Yorkshire Commercial Motor Company of Leeds has built a lorry carrying 6 tons of wood in lengths up to 45 feet. Ordinary vehicles do not allow of the carriage of long pieces because of the limited platforms of the lorries and also on account of the unequal distribution of weight. To avoid




Lorry for transporting timber in long lengths.

these disadvantages the above company has fitted the chassis with two trestles of different heights ; the rear trestle is lower than the forward trestle and is fixed to the frame directly over the back axle ; the forward trestle is fitted just behind the motor. The respective height of the two trestles allow pieces to be sloped conveniently. This arrangement together with the well proportioned design, distributes the weight uniformly on the bearing points of the vehicle. Another advantage of this lorry is the relatively long platform compared with the space occupied by the steam generator and the machinery. The latter is of simple type, with large bearing surfaces, and is very well balanced. The generator and fire-box are of such dimensions that the tubes are always covered with water whatever the angle of tilt assumed by the lorry.

1309 – **"Silicate Cotton" as Insulating Material for Boilers and Refrigerators.**—Scott James, in *Ice and Cold Storage*, Vol. XIX, No. 221, pp. 103-104, 3 figures. London, August, 1916.

The writer criticises the name "silicate cotton", as unsuitable, since the substance does not contain any cotton, and suggests "silicate fibre" as a substitute. It consists actually of a silicate, or rather of a mixture of calcium silicate with silicates of other bases. The material is prepared from blast furnace slag, more especially from the semi-transparent portion, of a vitreous nature, and does not undergo any change on exposure to the air under ordinary conditions.

The slag is melted and a jet of steam blown through which divides the mass into an infinite number of small particles, of different shapes, containing air bubbles. One cubic foot of slag forms 12 cubic feet of silicate, which thus includes 11 cubic feet of air.

Besides being used for floorings as a noise absorbing agent, this material is employed for boiler laggings. It is now coming into use as an insulator for cold storage purposes as it has the advantage of being absolutely incombustible and non-fermentable, while from the thermal point of view, it is one of the worst conductors known.

1310 – **Review of Patents.**

*Tillage Implements.*

| | | |
|---|---|---|
| Austria | 72 056 | Cultivator. |
| | 72 058 | Motor plough. |
| Canada | 168 704 | Hoe and cultivator combined. |
| | 169 032 | Multi-furrow plough. |
| | 169 107 | Drain plough. |
| | 169 195 | Tractor plough. |
| | 169 269 | Share-lift. |
| | 169 364 | Roller coupled to plough. |
| | 169 372 | Harrow. |
| | 169 593 | Hoe. |
| | 169 852 | Method of fixing cultivator discs. |
| Germany | 292 096 | Method of fixing the share to the frame, easily detached, especially for tractor ploughs. |
| | 292 129 | Spring connection for share of motor plough. |
| | 292 130 | Cultivator with rotating knives, with axis of rotation parallel with the line of work. |
| | 292 181 | Cultivator with vertical knife-bearing drums. |
| | 292 411 | Grips for motor plough and other wheels, with pieces situated on the plane of the axle. |
| | 292 412 | Chassis for reversible plough, working on the balance-plough principle. |
| | 292 438 | Tractor plough. |
| | 292 439 | Motor plough with fixed shares, adjustable for height by means of a rack. |
| | 292 628 | Device for fixing and unfixing ploughs coupled to the tractor chassis by means of a draw-bar. |
| | 292 629 | Plough furnished with frame detachable at side for tractor work. |

| | | |
|---|---|---|
| | 292 932 | Disc-harrow with articulated axles. |
| | 292 975 | Motor plough of driven disc type. |
| | 293 243 | Motor plough with frame adjustable as regards height by mechanical power. |
| | 293 408 | Mole-plough. |
| Holland | 1 590 | Cultivator with rotating toothed drum. |
| Italy | 153 252 | Transverse connection for fore carriage. |
| | 154 008 | Motor plough with driver rotary blades. |
| | 154 177 | Motor plough for special soils. |
| | 154 305 | Improvements in ploughs. |
| United States | 1 188 032 — 1 188 091 — 188 412 — 1 188 690. — 1 188 727 | Cultivators. |
| | 1 189 332 — 1 189 890 | Harrow. |
| | 1 189 365 | Wheel plough. |
| | 1 191 404 | Spiral harrow. |
| | 1 191 685 | Plough coulter. |
| | 1 191 850 | Attachment for cultivator. |
| | 1 194 087 | Ploughing machine with rotating cylinder. |
| | 1 194 166 | Plough. |

*Drainage and irrigation.*

| | | |
|---|---|---|
| Germany | 292 155 | Automatic device for sprinkling and irrigating with tipping receivers to control the valves. |

*Fertilizers.*

| | | |
|---|---|---|
| Canada | 169 161 — 169 162 — 169 163 | Process for fixing nitrogen. |
| | 169 491 | Process for calcium cyanamide manufacture. |
| Germany | 291 227 | Process and device for spreading fertilizers. |
| | 292 440 | Agitator and pump for liquid manure driven by electric motor. |

*Sowing and planting machines.*

| | | |
|---|---|---|
| Austria | 71 906 | Drill with distributor discs inside the hopper. |
| Canada | 170 148 | Drill. |
| Germany | 290 920 | Garden drill. |
| Italy | 153 484 | Drill and manure spreader. |
| United States | 1 189 019 | Drill for Maize. |

*Plant diseases: prevention and remedies.*

| | | |
|---|---|---|
| Austria | 70 878 | Method of protecting coniferous and other trees from rodents. |
| Germany | 290 611 | Process for making insecticide. |
| | 291 810 | Device for guarding vineyards and orchards against hail storms, |
| | 292 270 | Insecticide. |
| Italy | 153 302 | Insecticide for spraying. |
| | 153 525 | Improvement in continuous jet sprayers. |
| | 153 761 | New improved sprayer for blight and insects. |

*Harvesting and haymaking machinery.*

| | | |
|---|---|---|
| Austria | 70 085 | System for converting mower to binder. |
| | 70 512 | Reaper. |
| | 70 656 | Reverse mechanism for driving-wheel of binder. |

| | | |
|---|---|---|
| Canada | 169 397 | Rake. |
| | 169 497 | Sheaf-maker. |
| | 170 404 | Binder. |
| Denmark | 21 364 | Lawn mower. |
| | 21 398 | Self-binder. |
| Germany | 291 682 | Guard for mower running behind or at side of machine. |
| | 291 699 | Device for recovering grain and seed from self-binders. |
| | 291 715 | Knot for balers, binders, etc. |
| | 291 825 | Machine for making cocks. |
| United Kingdom | 6 768 | Reaper. |
| | 8 242 | Horse rake. |
| United States | 1 191 385 | Gear for coupling hay rake to lift. |
| | 1 194 788 | Teeth for hay rake. |
| | 1 195 320 | Maize binder. |

*Machines for harvesting root crops.*

| | | |
|---|---|---|
| Austria | 71 879 | Potato digger. |
| | 71 902 | Beet puller. |
| Canada | 169 839 | Potato digger. |
| France | 480 359 | Potato digger. |
| Germany | 291 688 | Device for raising the tines of potato digger. |
| | 291 706 | Seat for 2-wheeled potato digger. |
| | 291 714 | Topping machine for beets. |
| | 292 372 | Potato digger with projecting forks. |
| | 94 473 | Beet-puller fitted with endless belt transporter. |
| | 292 740 | Wheel with forks for potato digger. |

*Winnowing and threshing machines.*

| | | |
|---|---|---|
| Canada | 169 215 — 169 559 | Threshing machine. |
| | 169 253 | Mechanism for threshing machine. |
| Italy | 153 981 | Improvement in machine for separating grain coated with mucilage from grain not so coated. |

*Transport, dressing and storage of crops.*

| | | |
|---|---|---|
| Canada | 168 597 | Silage chopper. |
| | 169 813 | Hay lift. |
| Germany | 292 442 | Mechanism for clutching and de-clutching the feed of straw-balers. (1) |
| | 293 105 | Binding device for straw-baler. |
| Italy | 153 897 | Fodder trussing machine. |
| United Kingdom | 5 894 | Hay lift. |
| United States | 1 191 105 | Maize lift. |
| | 1 192 056 — 1 192 307 — 1 194 179 | Hay lifts. |

*Steering and traction of farm machinery.*

| | | |
|---|---|---|
| Canada | 168 223 — 168 224 — 168 439 | Tractors. |
| Italy | 154 049 | Anti-skid device for tractor for difficult soils or heavy loads. |

(1) See *B.* November 1916, N°. 1209. (*E. d. N.*)

| | | |
|---|---|---|
| United States | 1 191 333 | Tractor motor. |
| | 1 191 858 — 1 192 423 | Tractors. |
| | 1 193 776 | Plough tractor. |
| | | *Feeding of stock.* |
| Austria | 72 015 | Feeding machine. |
| Germany | 293 106 | Feeding tray for fitting over manger. |
| | | *Apiculture.* |
| Italy | 154 157 | Improved hive. |
| | | *Manufacture of vegetable products.* |
| Austria | 70 902 | Kneading machine. |
| Canada | 169 334 | Flax dressing. |
| | 169 446 | Desiccator for food cakes. |
| | 169 545 | Cereal food in strip form. |
| Italy | 153 952 | Desiccator for grain, seed and flint. |
| | | *Dairy industry.* |
| Austria | 69 998 | Draw-off tap for milking machine. |
| | 71 109 | Churn mechanism. |
| Canada | 169 284 | Pulsator for milking machine. |
| | 169 285 | Can-filling machine. |
| | 170 146 | Milk filter. |
| | 170 425 | Fat separator for creamery. |
| | | *Miscellaneous.* |
| Austria | 70 255 | Meat chopper. |
| | 70 803 | Country stove. |
| | 70 815 | Trocar. |

FARM BUILDINGS

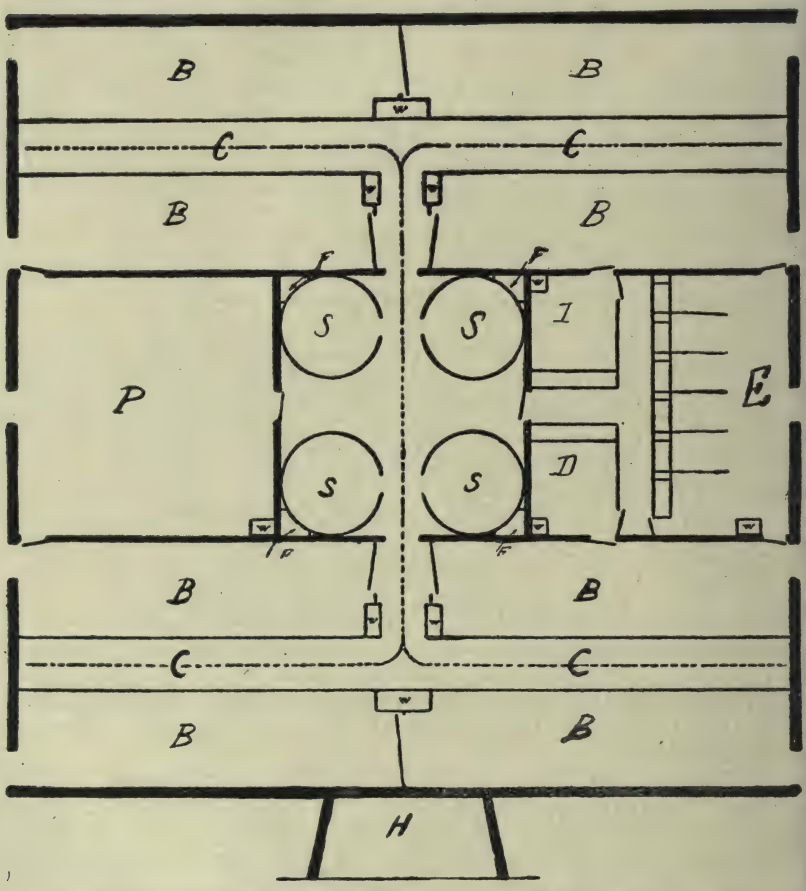
**1311 – Method of Housing Stock in Pens without Divisions in Use in Ohio, U. S. A.** — Hyslop G. L., in *Hoard's Dairyman*, Vol. LII, No. 6, p. 165, fig. Fort Atkinson, Wisc., September 1, 1916.

As shown in the accompanying figure, the stock building is divided into three parts : the cattle pens occupy the ends, while the silos, boxes, horse stables and a shed for fattening poultry are in the centre. The pens at each end form four compartments separated by the feeding passage, 4 feet wide, which also serves as a manger and is fitted with an overhead travelling skip for carrying the food. This skip, 3.7 × 4.2 feet in size, can carry from 1000 to 1200 lbs. of ensilage.

Barriers, moved by a lever, control the animals during feeding. The use of the feeding passages as mangers saves a space of 4 feet throughout the building that would normally be occupied by mangers. Feeding is thus more convenient and there is less waste.

The cattle pens measure 42 × 13 ft. without the feeding passage; the latter occupies 40 sq. ft. per animal. Each pen holds 13 cows (there is room for 16) or 16 bullocks. The floor of the pens and passages is of concrete. The platform on which the beasts stand when controlled by the bar-

riers is raised 6 inches above the floor level. Each pen receives 150 lbs. of straw daily, and when the manure is 1 foot deep, another 100 lbs. of straw is added. The bullocks receive their litter once, the cows twice a day, for the second time at the evening milking. The writer states that with this




Plan of stock buildings with open pens at "West View Farm", Ohio.

B = Cattle
C = Feeding passage
D = Box stall
S = Silo
P = Fattening Crates for Chickens
W = Water
E = Horse Stalls
F = Ventilating Flue

system of housing there is less nuisance from milk than otherwise, and the animals are more comfortable. There is less labour for the men and the animals are quieter.

The 8 pens require 54 to 64 tons of straw for 6 months. The only

objection is the large amount of straw used, but the writer proposes to mix dry soil with the straw and intends to experiment with this next year.

The ventilation is on the " King " system which is according to the writer, most suitable for this kind of building.

## RURAL ECONOMICS.

1312 – **The Possibilities of Increased Crop Production.** — Russell E. J., in *The Journal of the Board of Agriculture*, Vol. XXIII, No. 6, pp. 555-560. London, September 1916.

In his presidential address on 6th September, at Newcastle, to the Agricultural Section of the British Association, Dr. E. J. Russell took as his subject the possibilities and prospects of increased crop production.

In the development of agricultural methods in England the three great lines of progress have been: *a*) the introduction, usually from Flanders, of crops that had not previously been grown on British farms, *b*) the removal of obstacles which prevented crops from making as full growth as they might, and *c*) the introduction of new methods for increasing the growth of the plant. The body of the address was devoted to a consideration of the means of *i*) increasing the yields per acre, and *ii*) reducing the cost per acre and increasing the certainty of production.

*Increased yields per acre.* The main obstacles to increased plant-growth lie in the climate and in the soil. Climate apparently cannot be altered; therefore crops and varieties suited to conditions must be grown. Soil can be altered, and it is possible to do a good deal in the way of changing it to suit the crops that are wanted. Light soils, clays and loams were each considered by Dr. Russell.

On *light* soil the two great obstacles to be overcome are the lack of water and the poverty in plant nutrients. The problem can be dealt with by increasing the depth of soil through which the roots can range, or by adding the necessary colloidal substances, clay, marl, or organic matter. The addition of organic matter must generally be accompanied by the addition of lime or limestone and all the plant nutrients — nitrogen, potash and phosphates — as well as by constant cultivation to keep down weeds and retain soil moisture. When all this is done, light soils become very productive; but on account of the costs of the above processes, crops must be grown which bring in a high money return — potatoes, greens, peas, sugar-beet, or two crops in a season. The best hope for improvement of light soil lies in increasing the number of money-finding crops, improving the methods of growing them and the relation to the other crops, or the live stock, and improving the organization for disposing of them, so that farmers will feel justified in spending the rather considerable sums of money without which these light soils cannot be successfully managed.

*Heavy land* can be improved by liming or chalking followed by drainage. Mole drainage promises to be an efficient and much cheaper substitute for the old system of draining, but co-ordination and a certain amount of con-

trol over the whole drainage area is needed, it being undesirable that a great fundamental improvement should be at the mercy of individuals.

The cultivation of clay land is always risky however, as it is suited only to a limited number of crops, and is difficult to cultivate, and hence most men lay down this land to permanent grass. This risk can be reduced:

*a*) by quicker ploughing in autumn so as to bring the work well forward; this seems only possible by the use of the motor plough. Dr. Russell believes that motor ploughs and cultivating implements will play a considerable part in the improvement of heavy land;

*b*) by keeping up the supplies of organic matter in the soil; the simplest plan seems to be the adoption of the North Country system, in which the land is alternately in grass and in tillage. Dr. Russell thinks that demonstrations on such lines, in heavy land districts, would resolve many of the farmers' doubts as to the advisabilty of breaking up some of their grass land.

*Loams* present no special dfficulties. The crop may be hampered by lack of root room, in which case periodical deep ploughing or subsoiling may bring about a substantial improvement; subsoiling at Rothamsted at a cost of about £ 1 per acre was followed by an increased yield per acre of 10 cwt. of potatoes worth 35 s.

All the above soils can next be further improved by proper treatment with fertilisers. Dr. Russell anticipates considerable improvements from a closer co-ordination of crop variety and soil and climatic conditions.

*Reduction of Cost per Acre and Increase of Certainty of Production.* One of the most hopeful ways of attacking this problem is to increase the efficiency of the manurial treatment; the whole of the fertilising constituents applied to the soil are never recovered in the crops but by arranging a proper rotation, and by using a poperly balanced manure the loss can be much reduced. As regards this latter point Dr. Russell pleads for agreement between the county authorities as to a uniform scheme in their manurial experiments. Economy is also possible in the management of farmyard manure, the production of which is estimated at 37 million tons annually, valued at £ 9 250 000, compared with an annual consumption of £ 6 500 000 worth of artificials.

Further saving is possible in the soil itself; where there is no crop there is a loss of valuable nitrates over the winter, the heaviest loss occurring on the best manured land. This emphasises the need for spring dressings of quick-acting nitrogenous manures, and accounts for the marked improvements that set in on many soils when spring dressings are given. A good way of getting round the difficulty is to sow a catch crop in autumn and either to plough it in before the main crop is sown, or to feed it to stock whichever is more convenient. Leaving arable land in grass for a few years the gain in nitrogen, during this period, may balance the loss during the arable period; this is already done in several rotations, but it suffers from the disadvantage that the land during its recuperative grass period is producing less than during the arable period. Dr. Russell next dealt with the improvement possible in cul-

tivation, which will result from the use of the motor plough, or tractor, and alluded finally to economy in the choice of crops.

The need for accounts was emphasised, as enabling unprofitable crops to be replaced by profitable. *Swedes* e. g. are invariably grown at a loss at Rothamsted and Dr. Russell believes this would be found not uncommon in the south of England. The survey of the methods of increasing crop production was concluded by a reference to the need to raise by educational methods, the ordinary farmer to the level of the good one, to the need for extending the area of land under cultivation, by the reclamation of wastes, and to the need for the substitution of arable for grass.

Lastly, there is a factor which operates against increased crop production which Dr. Russell thinks it unreasonable to hope to see entirely abolished, and that is that a farmer has to get his pleasure out of the countryside, as well as find his work in it, so that trees, hedges and copses are left, pheasants bred, foxes and hares preserved and rabbits spared.

" When we know more about the soil, the animal, the plant, etc, we shall be able to increase our crop-yields ", says Dr Russell, " but we shall lose the best of our work if we put the crop-yield first. Our aim should be to gain knowledge that will form the basis of a true rural education, so that we may train up a race of men and woman who are alive to the beauties and the manifold interests of the countryside, and who can find there the satisfaction of their intellectual as well as their material wants. If we can succeed in that, we shall hear far less of rural depopulation; instead we may hope for the extension of that type of keen healthy countryman, which has always been found among the squires, farmers, and laborers of this country, and which we believe was already increasing before the War. With such men and women we can look forward with full confidence to the future.

1313 - **Comparative Results obtained on an Estate in Tuscany where a Farm Worked by the Landlord was Afterwards Run on the Metayage System.** — BRINI F., in *L'Agricoltura Italiana*, Year XLIII, pp. 100-104. Pisa, July-August 1916.

The Magognana farm at Poggibonsi, Tuscany is a holding of 10.87 hectares (27 acres) (1) of which 1.27 hectares is occupied by buildings, roads, etc., and 1.2 hectares by vineyards, leaving an area of 8.6 hectares for the arable fields. The holding used to be farmed on the landlord's account and under that management it was worked on a 9-years rotation, but when later the land was transferred to a metayer, a 4-course rotation was adopted at the same time.

The two rotations and the net returns per hectare under both systems are given below.

(1) 1 hectare = 2.47 acres.

| 1. *When under landlord*: | Lire |
|---|---|
| 1st year: Maize with bean. | 32 |
| 2nd " Wheat with clover seeds | 61 |
| 3rd " Clover | 116 |
| 4th " Wheat | 61 |
| 5th " Beans | 73 |
| 6th " Wheat with lucerne or sainfoin | 61 |
| 7th " Lucerne or sainfoin | 103 |
| 8th " " " " | 150 |
| 9th " Wheat, stubble grazed in autumn | 61 |
| Total | 718 |

* net return per hectare per annum 80 lire.

| *II. When under metayage*: | Total net returns — Lire | Landlord's share — Lire | Metayer's share — Lire |
|---|---|---|---|
| 1st year: Maize with beans and grazing previous autumn | 249 | 185 | 64 |
| 2nd " Wheat with clover seeds | 131 | 60 | 71 |
| 3rs " Clover | 162 | 38 | 124 |
| 4th " Wheat | 131 | 60 | 71 |
| One fifth of total area always kept on lucerne | 453 | 208 | 245 |
| Total | 1126 | 551 | 575 |
| * net return per hectare per annum | 225 | 110 | 115 |

| *Difference between two systems*: | Total net returns — Lire | Landlord's share — Lire | Metayer's share — Lire |
|---|---|---|---|
| Per hectare: | | | |
| under system II | 225 | 110 | 115 |
| " " I | 80 | 80 | — |
| Difference | 145 | 30 | 115 |
| On the whole farm (8.6 hectares): | | | |
| under system II | 1937 | 938 | 990 |
| " " I | 686 | 686 | — |
| Difference | 1251 | 252 | 990 |

No similar comparison can be drawn with regard to the returns from the vineyard, as the vines were newly planted and the conditions therefore not comparable in the two periods. But according to observations made in other vineyards worked first under the one system and then under the other, it is probable that the yield of wine was increased by between 2 and 3 quintals by the more careful management of the metayer who has a more personal interest in the welfare of the vines than the day labourer. Even by valuing the increased returns as low as 50 lire per hectare, the net returns of the holding amount to 2000 lire per annum or to 1313 lire more than when it was run on the landlord's account.

1314 – **Metayage on an Umbrian Estate (Italy).** — Papi C., in *L'Italia Agricola*, Year, 53, No. 8, pp. 353-363. Piacenza, August, 15, 1916.

On the Casalina Estate belonging to the Perugia Agricultural Institute a study was made of labour in its relation to different classes of land. The estate is situated in the Middle Valley of the Tiber, between Perugia and Todi, and covers an area of 1557 hectares (1) made up of :

750 hectares of drift or alluvial soils in the valley (loams)
700 " " sedimentary soils on the hillsides (clay or pebbly sand)
105 " " sedimentary soils on the mountain side (shingle)..

Considering the estate from the point of view of cropping it may be divided into :

896 hectares of arable land planted with rows of plane trees and vines every 25 to 30 metres ; situated on the flat or on gentle slopes where mowing and reaping machinery can well be used ; divided into 36 holdings of 18 to 40 hectares each, held by metayers.

255 " of arable land planted in vines and olives on the hillsides where horse tillage can be employed but where harvesting machinery cannot be used ; divided into 19 holdings of 10 to 18 hectares each and one holding of 37 hectares all held by metayers.

13 " of special crops (vines, olives, mulberries, nurseries) partly cultivated by the estate and partly worked on a system of metayage with the metayers of the other parts of the estate or with labourers from the town of Casalina

30 " of permanent grass and of poplar and willow plantations.

363 " of oak and cherry woods on the hillsides and mountains. All forestry work is undertaken by the estate whilst the grazings are in the hands of metayers.

On all the arable hand, it is estimated that the permanent crop (*i. e.* vines, olives, etc.) occupies one fifth of the area and that the rest is divided equally between corn and forage crops. Table I gives the value of the average production per hectare of both crops and stock during the three years 1912-1914.

The returns are very low when compared with those obtained on the best farms of Central Italy, but in order to develop the estate properly it will be necessary to regulate the course of the Tiber which at present does considerable damage to the low-lying land. On the hillsides, noticeable improvements have already been carried out though high yields can never be expected owing to the nature of the soil. The profits on live stock are higher in the hill zone than on the low ground chiefly because in the former no account is taken of the grazing provided by the woods. In Table II is set out the head of live stock and its distribution between high and lowland holdings.

At Casalina, the system of metayage in force is a good example of the old custom of partnership with equal shares : the land, buildings, live and dead stock belong to the landlord ; the smaller implements are mostly pro-

(1) 1 hectare = 2.47 acres.

TABLE I. — *Value per hectare of produce from crops and stock*, 1912-1914.

| | 1912 | 1913 | 1914 | Mean |
|---|---|---|---|---|
| | Lire (1) | Lire | Lire | Lire |
| *Lowland zone* (896 *hectares*) : | | | | |
| Value of field crops not consumed on the holding | 250 | 220 | 216 | 229 |
| Value of crops from plantations (almost entirely vines) | 59 | 38 | 57 | 50 |
| Net profits on live stock | 36 | 46 | 72 | 51 |
| *Hill zone* (255 *hectares*) : | | | | |
| Value of field crops | 147 | 133 | 140 | 140 |
| Value of crops from plantations (vines and olives trees) | 83 | 60 | 59 | 67 |
| Net profits on live stock | 79 | 59 | 99 | 77 |

(1) 1 lire = 9 ½*d*.

vided by the tenant ; all produce from field crops or trees and all losses or gains on the live stock are divided equally between landlord and tenant ; all expenditure on seeds, manures, fungicides, live stock taxes, insurance, veterinary fees, blacksmith, are also divided equally between the landlord and tenant ; the land tax is paid by the landlord and the income tax by the tenant ; the house and garden are the exclusive property of the tenant and so are the poultry, but the landlord makes some fixed rent charge for the latter. Such a system as this with slight modifications is adopted throughout Umbria.

Table III summarises the date dealing with the metayers and their families on the Casalina estate and distinguishes between the workers and, the consumers according to the classification suggested by FAINA (1). In Table IV the supplementary casual labour employed by the metayers during the years 1912-1914 is given. For the corn harvest, which is the work requiring most labour, it has been estimated that in normal times an additional 1960 men-days and 600 women-days are necessary, or assuming that the harvest lasts 12 days, an extra 163 men and 50 women would be employed on the land.

In calculating the proportion of workers in the metayer families, women, old men and children are assigned values varying from 3 tenths to 6

(1) Cf. *Nuova Antologia*, May 16, 1915 : Earnings and food consumption of metayers. Investigations on the earnings and food consumption of the metayers at Casalina have been made by the students of the Perugia Agricultural Institute.

TABLE II. — *Live stock on the estate, December* 31, 1914.

| | Mean live weight per head | Total head | Total live weight | Total head per hectare | Total live weight per hectare |
|---|---|---|---|---|---|
| *Lowland zone* (36 *farms*): | Quintals (2) | | Quintals | | Quintals |
| Bulls | 10 | 4 | 40 | | |
| Bullocks (working) | 9 | 110 | 990 | | |
| Cows | 7 | 93 | 651 | 0.3 | 2.3 |
| Calves | 1 | 32 | 32 | | |
| Yearling cattle | 5,5 | 69 | 380 | | |
| Mares | 5,5 | 40 | 220 | | |
| Foals | 3 | 43 | 129 | 0.1 | 0.4 |
| Asses | 2 | 2 | 4 | | |
| Pigs | — | 454 | — | 0.5 | — |
| Sheep | — | 138 | — | 0.2 | — |
| *Hill zone* (20 *farm*): | | | | | |
| Bullocks (working) | 8 | 48 | 384 | | |
| Cows | 6 | 10 | 60 | | |
| Calves | 1 | 4 | 4 | 0.3 | 2.0 |
| Yearling cattle | 5 | 14 | 70 | | |
| Mares | 5 | 9 | 45 | | |
| Foals | 3 | 14 | 42 | 0.1 | 0.4 |
| Asses | 2 | 3 | 6 | | |
| Pigs | — | 237 | — | 0.9 | — |
| Sheep | — | 211 | — | 0.8 | — |

(2) 1 quintal = 220.5 lbs.

tenths of the normal man-day. The writer points out that the chief characteristic of the system of metayage is its remarkable elasticity with regard to supplying labour. For instance at the present time when 20 per cent of the men are away, the harvest was nevertheless carried out by the families of the metayers with the help of only an additional 80 people from the town of Casalina. This fact has suggested the possibility that up to the present the labour of the metayers and their families has not been used to the best advantage. That the subdivision of holdings — a process with which the growth of intensive farming was thought to be intimately connected owing to the consequent increase of labour in the form of metayage — may not be an economical procedure beyond a certain point, partly because it means

TABLE III. — *Composition of the metayer families.*

| | Whole estate | Lowland zone | Hill zone |
|---|---|---|---|
| Total number of families | 56 | 36 | 20 |
| Total number of individuals | 810 | 614 | 196 |
| Males | 433 | 329 | 104 |
| Females | 377 | 285 | 92 |
| Males under 10 years | 314 | 243 | 71 |
| Females | 260 | 191 | 69 |
| Workers | 382 | 294 | 88 |
| Consumers | 680 | 513 | 167 |
| Mean composition of one family — Males | 7.7 | 9.1 | 5.2 |
| Mean composition of one family — Females | 6.7 | 7.9 | 4.6 |
| Mean composition of one family — Workers | 6.8 | 8.2 | 4.4 |
| Mean composition of one family — Consumers | 12.2 | 14.3 | 8.4 |
| Per hectare of arable Land — Total number of individuals | 0.7 | 0.7 | 0.7 |
| Per hectare of arable Land — Workers | 0.3 | 0.3 | 0.3 |
| Per hectare of arable Land — Consumers | 0.6 | 0.6 | 0.6 |
| Number of individuals absent temporarily | 92 | 70 | 22 |

TABLE IV. — *Casual labour employed by metayers, average of three years* (1912-1914).

| | Men | Women |
|---|---|---|
| | days | days |
| May | 770 | 170 |
| June | 930 | 210 |
| July | 1 700 | 370 |
| August | 395 | 88 |
| September | 230 | 52 |
| October | 700 | 150 |
| November | 70 | 20 |
| | 4 795 | 1 060 |
| Average per hectare over whole period — lowland zone | 4.4 | 0.9 |
| Average per hectare over whole period — hill zone | 3.3 | 1.0 |

the sinking of capital and partly because it raises the price of labour and limits the use of farm machinery. It would appear that the best results might be obtained by a combination of metayage and casual labour, where the holdings are large enough and remunerative enough to employ a certain amount of outside labour for which a fair price could be paid.

1315 – **Government Share-Farming Experiment in New South Wales,** in *The North British Agriculturist ;* Vol. LXVIII, No 38, pp. 579. Edinburgh, September 21st 1916.

The Government of New South Wales has just entered upon an experiment in share-farming on the Forest Vale Estate of 20.000 acres between Wyalong and Lake Cudgehico. The homestead block of 1500 acres is to be used as an experimental farm, under the control of the Department of Agriculture. The balance of the area has been subdivided into twenty farms of about 800 acres each, which it is intended to apportion out, on the new system between as many applicants should as many as twenty be forth coming.

The farms, although meant to be run on a profit-sharing basis, will be kept strictly under control as regards methods of working. Thus of the 800 acres, 500 acres must be used for cultivation purposes the remainder being devoted to grazing. Again of the 500 arable acres, 250 must be sown each year and 250 acres fallowed. Ten acres must be ploughed and planted for afforestation purposes. Sheep should be run on each block, and assistance may be given regarding the purchase of these sheep The share-farmer is to find his own equipment for putting in and taking off the crop, to find his share of the bags aud to pay for his share of tke cartage. The share-farmer is to have two-thirds of the whole of the crop, whether cut for hay or stripped for grain. For the 550 acres (about) of grazing and fallowed land the farmer will pay to the crown rental at the rate of 2 ½ per cent on the improved capital value. The Government's share will be one-third of the crop, and the Government will find its own share of the bags pay its share of the cartage and find the whole of the manure necessary for the cultivation area. Houses will be built for the settlers who will be consulted regarding details. The land will be cleared and fenced, and a store will be established. A saw-mill will be provided in a central situation, and about three-quarters of a million feet of timber will be cut on the property for houses, sheds etc. There are various other minor conditions, and it is provided that the whole will be embodied in a contract of lease between the parties and the Government. Applicants in applying for farms must state whether they are natural born or naturalised British subjects ; whether married or single ; the extent of practical farming experience already possessed ; the amount of capital on hand, and other such-like particulars.

1316 – **The Examination and Interpretation of Data in Investigations on Agricultural Economics.** — MARENGHI E., in *L'Eco degli ingenieri e periti agrimensori*, Year XX, Nos. 6 to 16, pp. 61, 76, 85, 97, 111, 122, 135, 160, 178, 181. Pescia, March to August 1916.

Many investigations in agricultural economics are based on data drawn from various sources and unless these are subjected to a critical examination

before being used, they can lead to very erroneous conclusions. The present paper deals solely with methods of testing data and with the means adopted for making them more reliable.

Data collected from different sources are not always comparable and in order to check such figures it is often possible to make use of calculated values drawn from a single secondary source For instance, in order to check the data on the production of forage crops in 27 districts of the Province of Rome (1), the unit consumption was worked out for each district (Table I) from the weight of live stock maintained and the amount of fodder required to feed a unit weight of live stock per annum, assuming that it takes 12 parts of hay or hay equivalents to maintain 1 part of live weight for 1 year. There is little agreement between the two sets of figures, showing that the returns for the forage crops, or for the live stock or for both were unreliable. Some sources of error there must always be even in the most careful records of this kind, but they should not be of an order to suppress all correlation between the two sets of returns. Assuming that the live stock returns are more likely to be correct than the forage returns, it follows that the latter should only be used with caution.

Another method of checking the reliability of data is based on the fact that there should be some sort of order connected with the chronological sequence. For example in Tables II and III, data are set out representing the production of olive trees and vines over the period of their growth, the data being collected by various investigators and in different parts of Italy. When plotted, the data give rise to very irregular curves which are a direct proof of errors in the returns, as except in cases where considerable modifications take place in the treatment of the plantations or where a disease appears, the average yield from such permanent crops should give a fairly smooth curve.

Ordinary statistical returns collected by the Government are often very imperfect. During the Enquiry into the conditions of the agricultural population in the south of Italy, it became apparent that the data on the numbers of metayers, farmers, etc., published in the population census were almost useless. A confusion had been caused by the bad wording of the schedules on which the returns were collected, the various classes of holders not being sufficiently well defined, so that under the group metayage were entered not only the various kinds of tenant parternerships, but also ordinary tenant farmers and other types of tenancies.

Besides testing the reliability of data, a critical examination often indicates a means of improving them and of smoothing out curves by the use of arithmetic, algebraic or graphic methods (2). By thus eliminating oscillations due to incidental causes the general trend of the phenomena under discussion is more clearly defined. The use of arithmetic methods is particularly adapted to chronological series where the irregularities are

(1) *Ministero di Agricoltura, Industria e Commercio, Ufficio di Statistica agraria, Catasto agrario del Regno d'Italia*, Vol. VI, No. 3, Part 2, pp. 11-65. Rome 1916.

(2) See *R.* 1914, No. 845.

TABLE I. — *Production of dry fodder per hectare in the Province of Rome.*

| | District | Production of dry fodder per hectare | | Weight of livestock per hectare |
|---|---|---|---|---|
| | | From crop returns | Calculated from Live stock returns | |
| | | Quintals | Quintals | Quintals |
| 1 | Volscian Hills | 7.60 | 7.92 | 0.66 |
| 2 | Lake of Bolsena | 5.20 | 8.40 | 0.70 |
| 3 | Bognorea Hills | 8.70 | 9.60 | 0.80 |
| 4 | Orte and Civitacastellana | 7,10 | 7.32 | 0.61 |
| 5 | Soracte | 6.20 | 10.68 | 0.89 |
| 6 | Viterbo | 5.70 | 6.72 | 0.56 |
| 7 | Cimini | 4.70 | 7.32 | 0.61 |
| 8 | Maremme (inland) | 6.40 | 9.60 | 0.80 |
| 9 | Vetralla | 5.20 | 8.28 | 0.69 |
| 10 | Maremme (coast) | 5.20 | 9.48 | 0.79 |
| 11 | Civitavecchia | 8.10 | 11.76 | 0.98 |
| 12 | Lake of Bracciano | 7.80 | 11.16 | 0.93 |
| 13-16 | Agro Romano (3 districts) | 15.80 | 12.96 | 1.08 |
| 17 | Anzio and Nettuno | 7.60 | 7.80 | 0.65 |
| 18 | Upper Valley of the Anio | 5.80 | 9.12 | 0.76 |
| 19 | Valley of the Tiber | 8.50 | 11.04 | 0.92 |
| 20 | Prenestina | 4.00 | 8.04 | 0.67 |
| 21 | Alban Hills | 4.70 | 11.88 | 0.99 |
| 22 | Simbruini Hills | 5.90 | 6.12 | 0.51 |
| 23 | Velletri and San Paliano | 4.50 | 13.92 | 1.16 |
| 24 | Val Sacco | 6.00 | 18.00 | 1.50 |
| 25 | Lepini Hills | 5.40 | 9.24 | 0.77 |
| 26 | Ausoni Hills | 6.40 | 11.16 | 0.93 |
| 27 | Pontine Marshes | 7.20 | 13.80 | 1.15 |

due not so much to the way the returns are collected as to incidental causes. In the series of figures dealing with the production of a vineyard during the early years of its life (series *A*, Table IV), there is some anomaly in the figures for the seventh to the tenth years. By using Wittstein's method of determining the means of 3 terms, the series *B* is obtained which is far more regular. Or by applying the algebraic method, *i. e.* interpolating a parabola of the second order according to the method of the least squares, the series *C* is obtained. The geometric or graphic method also gives good results. This method consists in representing the actual figures by a Cartesian diagram and in interpolating in it a curve which approaches the same series.

TABLE II. — *Production of vines (chronological series).*

| In rows, wide apart, on cultivated fields | | | | | | In vineyards | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Bologna district (CANEVAZZI) | | Central Italy (MONTI) | | Terra di lavoro (MUZII) | | Abruzzi (MUZII) | | Apulia (FLORES) | | Sicily (BRUTTINI) | |
| Age | Mean yield of grapes per 100 hills | Age | Mean yield of grapes per 100 hills | Age | Mean yield of grapes per 100 hills | Age | Mean yield of grapes per 100 hills | Age | Mean yield of grapes per 100 hills | Age | Mean yield of grapes per 100 hills |
| Years | Kgs. | Years | Kgs. | Years | Kgs. | Years | Kgs. | Years | Kgs. | Years | Kgs. |
| 0 to 10 | — | 0 to 16 | — | 0 to 6 | — | 0 to 5 | — | 0 to 3 | — | 0 to 4 | — |
| 11 » 20 | 150 | 17 » 30 | 1090 | 7 » 10 | 900 | 6 » 15 | 45 | 4 » 8 | 26 | 5 » 14 | 40 |
| 21 » 25 | 856 | 31 » 60 | 1500 | 11 » 15 | 2700 | 16 » 25 | 100 | 9 » 13 | 32 | 15 » 24 | 60 |
| 26 » 35 | 1612 | 61 » 70 | 1310 | 16 » 30 | 4500 | 26 » 35 | 35 | 14 » 28 | 49 | 25 » 34 | 65 |
| 36 » 55 | 2092 | 71 » 80 | 1010 | 31 » 35 | 3600 | 36 » 50 | 25 | 29 » 34 | 35 | 35 » 44 | 52 |
| 56 » 80 | 1660 | — | — | 36 » 42[1] | 1800 | — | — | 35 » 38 | 32 | 45 » 55 | 38 |
| — | — | — | — | 43 » 60 | 2700 | — | — | 38 » 40 | 25 | — | — |

(1) Old vines replaced by runners at 40 years with a consequent increase of production.

TABLE III. — *Production of olive trees (chronological series).*

| Pisani Hills (GUPPARI) | | Umbria (MONTI) | | Provincia of Bari (SOMMA) | | Territory of Gallipoli (MUZII) | |
|---|---|---|---|---|---|---|---|
| Age | Mean yield per tree | Age | Mean yield per tree | Age | Mean yield per tree | Age | Mean yield per tree |
| Years | Kgs. | Years | Kgs. | Years | Kgs. | Years | Kgs. |
| 0 to 10 . . | — | 0 to 12 | — | 0 to 14 | — | 0 to 12 | — |
| 11 » 16 . . | 0.67 | 13 » 30 | 0.46 | 15 » 20 | 0.56 | 13 | 3.63 |
| 17 » 21 . . | 0.78 | 31 » 50 | 0.87 | 21 » 30 | 1.27 : | 15 | 4.32 |
| 22 » 26 . . | 0.95 | 51 » 200 | 1.13 | 31 » 40 | 2.40 | 21 | 6.40 |
| 27 » 31 . . | 1.11 | | | 41 » 50 | 2.50 | 25 | 7.78 |
| 32 » 36 . . | 1.33 | | | 51 » 60 | 3.90 | 31 | 10.03 |
| Above 36 . . | 1.44 | | | 61 » 70 | 4.80 | 35 | 11.41 |
| | | | | 71 » 80 | 5.55 | 41 | 13.65 |
| | | | | 81 » 90 | 5.85 | 45 | 15.04 |
| | | | | | | 51 | 17.29 |

The values of the ordinates corresponding to the theoretical curve are then determined according to scale.

Grouping data in fairly large classes is another method of obtaining satisfactory approximations. Returns for the regional production of wheat

TABLE IV. — *Data treated by the arithmetic and the algebraic methods production of a vineyard in quintals per hectare.*

| Age of vineyard in years | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|
| *A.* Figures actually recorded . . . | 7.50 | 8.15 | 7.90 | 9.00 | 9.65 | 9.40 | 10.30 |
| *B.* » treated arithmetically . | 7.50 | 7.85 | 8.35 | 8.85 | 9.35 | 9.78 | 10.30 |
| *C.* » » algebraically . | 6.86 | 7.44 | 8.10 | 8.84 | 9.16 | 10.66 | 11.54 |

TABLE V. — *Average earnings of metayers in Central Italy per "man unit" per annum.*

| Locality | Authority | No of estates studied | Earning per "man unit" per annum | | |
|---|---|---|---|---|---|
| | | | Maximum | Minimum | Mean |
| | | | Lire | Lire | Lire |
| Tuscany | MAZZINI (1) | 14 | 310 | 200 | 282 |
| » | LINARI (2) | 51 | 479 | 139 | 256 |
| » | BRUTTINI (3) | 21 | 525 | 177 | 283 |
| Tuscany — Val d'Elsa | GUICCIARDINI (4) | 31 | 641 | 356 | 485 |
| Tuscany — Val d'Arno | GUICCIARDINI (4) | 19 | 642 | 360 | 489 |
| Tuscany — Pistoian Hills | GUICCIARDINI (4) | 18 | 539 | 320 | 396 |
| Umbria (S. Venanzio) 1913 | FAINA (5) | 9 | 639 | 123 | 336 |
| Umbria (S. Venanzio) 1914 | FAINA (5) | 9 | 605 | 142 | 348 |
| Umbria (Middle Tiber Valley) | BINDOCCI (6) | 52 | 771 | 131 | 407 |
| Marches (Pesaro) | NICOLETTI (7) | 40 | 480 | 51 | 160 |

(1) *Atti della Giunta per l'Inchiesta Agraria*, Vol. III, No. 1, p. 470.
(2) *L'Agricoltura Italiana*, 1902, No. 12.
(3) *Bollettino della Soeietà degli Agricoltori Italiani*, Aug. 31, 1905.
(4) *Nuova Antologia*, April 16, 1907.
(5) *Id.* March 16, 1905. — According to this authority: 1 adult man = 1 man unit, and 1 adult woman = $^{6}/_{10}$ man unit.
(6) "Il guadagno del mezzadro nella media Valle del Tevere". Perugia, 1916.
(7) *Bollettino dell'emigrazione*, 1909, No. 20.

in Italy (1909) proved satisfactory because the areas involved were large, but returns collected on the old method of small areas are open to criticism.

The homogeneity of data is a fair indication of their reliability and consequently has a marked influence on the correctess of the conclusions drawn from them. As an illustration of the necessity of a preliminary enquiry into the homogeneity of data before using them as terms of comparison, the

earnings of metayers in Central Italy are collected from various authorities and set out in Table V. If the object were to show the average earnings per man under the metayage system in different parts of Central Italy, the figures would not be comparable for in working out the available labour in each group and reducing to " men units ", the factors employed were not constant. But if the object were merely to show the relationship between the earnings and the general fertility of the holdings the figures might be taken as comparable. The Table shows a very large range of variation in the earnings of metayers, for the metayage contracts tend to remain the same even in districts where yields differ markedly.

The homogeneity of the data must therefore be subordinated to the object in view. If, for instance, the yield of wheat per unit is being considered in countries which differ in regard to climate or other physical conditions, the data may be looked upon as homogeneous and therefore comparable if it is a question of shcwing that the phenomenon is a variable one. On the other hand the data will not be homogeneous if it is a question of appraising the values of the different systems of cultivation, for the yield does not only depend on the skill of the farmer but also on the general physical conditions of the surroundings.

Errors of judgment of the kind are frequently committed especially in dealing with questions of deforestation. The returns under a permanent system of forest management are compared whit those whichcould be obtained by farm crops, no account being taken of the fact that the latter may only be transitory and grown at the expense of the accumulated capital in the land. Other examples of the same kind are the comparison of the wealth of nations or individuals under different conditions of locality or time or the comparison of wages when the economic conditions are not the same, etc.

Passing on to the methods of classification, grading and comparison employed in the interpretation of data and to Galton's index of correlation it is pointed out that the statistical study of agricultural problems will only reveal gross influences at work, for any one mass of facts whatever its nature is connected with a number of others and expresses therefore the result of the action of an indefinite number of variable factors. The correlation was determined between the yields of lucerne and the rainfall (Table VI) from data collected by the Agricultural Institute at Perugia, According to the formula (1).

$$\text{Coefficient of correlation, } r = \frac{14893.60}{\sqrt{13584.33 \times 75240.40}} = 0.49.$$

or in other words, the yields of lucerne are largely controlled by the spring

(1) Coefficient of correlation, $r = \dfrac{\Sigma(xy)}{\sqrt{\Sigma(x^2)}\ \sqrt{\Sigma(y^2)}}$

where $x$ and $y$ are the mean deviations in each series when the deviations are static. In cases where they are dynamic the above deviations are replaced by the difference between each effective term and the corresponding term of the normal curve which is plotted by a special process of interpolation.

rainfall. Again LENOIR (1) has worked out the coefficient of correlation between the production and the price of wheat in France with the following results :

| | | | | | |
|---|---|---|---|---|---|
| From 1847 to 1870 | the coefficient of correlation | was | . . . . | 0.75 |
| " 1871 " 1885 | " | " | " | . . . | 0.56 |
| " 1885 " 1905 | " | " | " | . . . | 0.34 |

showing that as the cereal market tends to become world wide, so the influence of the home production on prices tends to diminish.

With regard to the interpretation of agricultural experiments, it should be borne in mind that they hardly ever manage to isolate the action of the factors under investigation, for the experiments usually deal with plants and animals whose functions do not lend themselves to study under rigidly homogeneous conditions. As a case in point the probable error (2) was worked out for two of Wagner's series of results dealing with manurial experiments. (Table VIII). The mean increase in yield with nitrate of soda is 6.4 kg., while the probable error is 0.66 showing that the increase is due to the manuring and not to incidental causes.

From another set of results Wagner estimates the mean relative efficiency of ammonia nitrogen (nitrate nitrogen being taken as 100), from series showing considerable variation as follows :

| | Relative efficiency | |
|---|---|---|
| | Mean | Highest and lowest figures |
| Wheat . . . . . | 87 | 13 to 107 |
| Rye . . . . . | 76 | 52 " 109 |
| Barley . . . . . | 72 | 42 " 109 |
| Oats . . . . . | 90 | 61 " 124 |

These figures were worked out by GRÉGOIRE (3), taking into account the unit price of the two manures, and the results are given in Table VIII, from which it is much easier to judge of relative economic advantages of the two forms of nitrogen.

The probable error is also employed to determine :

1) The minimum amount of data required for the statistical study of a problem, using the formula $n = \varphi^2/E^2$ which is obtained from that of the probable error ($E$) and from the mean of a series of terms $E = \varphi n$ where $\varphi$ = probable error of each term and $n$ = number of terms ;

(1) M. LENOIR. Etude sur la formation des prix. Paris, 1913.

(2) Probable error, $Ed = 0{,}48 \sqrt{\frac{2\sum(d_1^2)}{n_1(n_1-1)} + \frac{2\sum(d_2^2)}{n_2(n_2-1)}}$

where $\sum(d_1^2)$ and $\sum(d_2^2)$ are the sum of the deviations squared and $n_1$, $n_2$ are the number of terms.

(3) A. GRÉGOIRE, Les recherches agronomiques et l'interpretation de leurs résultats. *Annales de Gembloux* 1912, pp. 52-58.

TABLE VI. — *Correlation between rainfall and yield of Lucerne.*

| Year | Spring rainfall mm. | Deviation from the mean: Simple ($x$) | Deviation from the mean: Squared ($x^2$) | Annual yield of lucerne per hectare Quintals | Deviation from the mean: Simple ($y$) | Deviation from the mean: Squared ($y^2$) | Product of deviations ($xy$) |
|---|---|---|---|---|---|---|---|
| 1903 . . . . | 209 | — 21.6 | 466.56 | 150.90 | + 40.35 | 1 628.12 | — 871.56 |
| 1904 . . . . | 118 | — 112.6 | 12 678.76 | 142.70 | + 32.15 | 1 033.61 | — 3 620.09 |
| 1905 . . . . | 345 | + 114.4 | 13 087.36 | 168.20 | + 56.65 | 3 323.52 | + 6 595.16 |
| 1906 . . . . | 299 | + 68.4 | 4 678.56 | 109.80 | — 0,75 | 0.56 | + 51.30 |
| 1907 . . . . | 212 | — 18.6 | 345.96 | 123.56 | + 13.01 | 143.26 | — 241.99 |
| 1908 . . . . | 132 | — 98.6 | 8 721.96 | 102,80 | — 7.75 | 60.06 | + 10 136.08 |
| 1909 . . . . | 109 | — 121.6 | 14 786.56 | 60.57 | — 49.98 | 2 498.00 | + 6 077.57 |
| 1910 . . . . | 342 | + 111.4 | 12 369.96 | 79.00 | — 31.55 | 995.40 | — 3 514.67 |
| 1911 . . . . | 220 | — 10.6 | 112.36 | 48.00 | — 62.55 | 3 812.50 | — 663.03 |
| 1912 . . . . | 320 | + 89.4 | 7 992.36 | 120,00 | — 9.45 | 89.30 | + 944.83 |
| | *Mean* 230.6 | $\Sigma (x^2) = 75\,240.40$ | | *Mean* 110.55 | $\Sigma (y^2) = 13\,584.33$ | | $\Sigma (xy) = 14\,893.60$ |

TABLE VII. — *Manurial trials with nitrate of soda ; probable error of results.*

| | Unmanured plots: Production Kgs. | Unmanured plots: Deviation from the mean: Simple ($d_1$) | Unmanured plots: Deviation from the mean: Squared ($d_1^2$) | Manured plots: Production Kgs. | Manured plots: Deviation from the mean: Simple ($d_2$) | Manured plots: Deviation from the mean: Squared ($d_2^2$) |
|---|---|---|---|---|---|---|
| | 20.1 | + 0.6 | 0.36 | 26.2 | + 0.3 | 0.09 |
| | 20.3 | + 0.8 | 0.64 | 26.9 | + 1.0 | 1.00 |
| | 18.7 | — 0.8 | 0.64 | 23.3 | — 2.6 | 6.76 |
| | 18.9 | — 0.6 | 0.36 | 27,1 | + 1.2 | 1.44 |
| *Totals* | 78.0 | —— | 2.00 | 103.5 | —— | 9.29 |
| *Means* | 19.5 | —— | 0.50 | 25.86 | —— | 2.32 |

$$Ed = 0.48 \sqrt{\frac{2 \times 2}{4 \times 3} + \frac{2 \times 9.29}{4 \times 3}} = 0.66$$

2) The best size for experimental plots. In this connection the results of LARSEN in Sweden may be cited :

| Size of plot | Probable error |
|---|---|
| 1/16 are (1) . . . . . | 16.7 per cent of the mean |
| 1/8 " . . . . . | 10.7 " " |
| 1/4 " . . . . . | 9.8 " " |
| 1/2 " . . . . . | 8.5 " " |
| 1 " . . . . . | 7.7 " " |

(1) 1 are = 0.025 acres.

TABLE VIII. — *Relative efficiency of ammonia nitrogen and nitrate nitrogen as worked out by Grégoire.*

| Crops | No. of experiments | Percentage probability of obtaining better returns from nitrate nitrogen than from ammonia nitrogen when the price of nitrate nitrogen is taken as 100 and the relative price of ammonia nitrogen is: | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
| | Per cent | Per cent | Per cent | Per cent | Per cent | Per cent | Per cent | Per cent | Per cent |
| Wheat . . . . . | 25 | 24 | 28 | 36 | 52 | 68 | 92 | 96 | 96 |
| Rye . . . . . | 58 | 10 | 22 | 36 | 53 | 76 | 86 | 90 | 95 |
| Oats . . . . . | 30 | 3 | 7 | 23 | 27 | 27 | 70 | 87 | 90 |
| Barley . . . . . | 51 | 20 | 31 | 43 | 61 | 76 | 90 | 94 | 96 |
| Potatoes . . . . . | 25 | 8 | 8 | 12 | 28 | 48 | 72 | 80 | 88 |
| Sugar beet . . . . | 40 | 25 | 30 | 45 | 60 | 75 | 92 | 95 | 100 |
| Mangolds . . . . . | 48 | 23 | 40 | 62 | 81 | 92 | 98 | 100 | 100 |

These results, which have been confirmed by other authorities, show that the probable error decreases as the size of the plot increases, but not proportionately so that in practice it is usual to adopt unit areas not larger than 100 sq. metres, for with bigger plots, it becomes increasingly difficult to find a suitable experimental area where the soil shows no variability.

3) The appropriate size of samples for analysis. RODEWALD has shown: *a*) that for seed samples 300 to 400 seeds are required for purity and germination tests, the error diminishing rapidly up to this point and but very slowly above it; and that the "error of tolerance" to be adopted is 2.22 per cent for seeds with a purity and germination capacity of 95 per cent. He also confirms NOBLE's conclusions (1) which were based on the results of practical experiments.

Summarising, the writer points out that the study of agricultural economics is a method of investigation which only yields approximate results as it is not always possible to isolate the required factors. The method, however, is the most logical one for obtaining a knowledge of the empirical laws governing the management of farms provided the data are collected with care and submitted to searching criticism.

1317 – **Farm Cost Accounting in the United States** in *The Breeder's Gazette*, Vol. LXX, No 13, p. 553, Chicago, September 27, 1916.

A wave of interest in farm cost accounting has been started by county agricultural agents in the United States. Some farm accounting has been done by the Minnesota and Illinois universities, from actual detailed annual farm records, showing the possibilities of a system of finding the cost of

(1) C. GINI. La regolarità dei fenomini rari, *Giornale degli Economisti*, March 1908, pp. 210-291.

horse labor, of growing a bushel of corn, and raising a pound of beef etc. The farm management surveys made in the last few years by cooperation of the Government and various state universities, have stirred up a demand for practical, simple systems of farm bookkeeping.

During the fall of the year, when the bulk of farm cash comes in, and the results of the year's work become apparent, a farm's accounts begin pointing the way to a revision of methods. Some crops have required more work than was estimated; machinery repairs count up to an unexpected total; plowing with a tractor costs more than the 50 cents per acre estimated when the tractor was bought; every revision of farm methods introduces uncertainty as to farm incomes; the necessity for exact information becomes very day more acute.

It is admittedly becoming difficult to figure a generous interest on land values. This of itself is driving ambitious farmers to keep accounts, so as to eliminate wasteful methods. The young farmer, who is trying to pay for land from its products, is driven to some such expedient. The evolution of efficient farm cost accounting systems will be therefore a great achievement, and progressive farmers who will take advantage of them, will be put further above the average of their fellows.

1318 – **Fixing the Price of Milk.** — Bocchicchio N., in *Il Coltivatore*, No. 28, pp. 298-30 Casale Monferrato, October 10, 1916.

In Italy it is generally considered that the milk produced by a cow should pay for the food consumed, the manure more than pay for the litter and the calf be left over as profit. The cost of the milk therefore varies directly with the cost of the food and inversely with the amount of milk produced o

where $p$ = cost of milk per annum
$V$ = " " food " "
$l$ = amount of milk produced per annum

25 per cent should be added to $p$ for profit and risk of owner, and in all large towns another $4d$ a gallon should be added for extra expenses connected with the production and distribution of the milk.

The cost of milk diminishes with the size of the cow as the food consumed is usually 12 times the cow's weight of hay or hay equivalents. So, provided she produces as much milk as a larger animal, the small cow is the more economical. Where the cows are used for draught purposes the production of milk is smaller, but the cost of the food is then lowered by the value of the work done, according to the formula $p = V - L/l$ where $L$ = the value of the work done. $L$ is usually greater than the value of the difference in the production of milk, and it is for this reason that milk is cheaper in small rural communities where the supply is drawn from the double purpose cow. As a general rule, the price of milk at the farm may be said to be equal to about twice the cost of the food, and the retail price in towns is about 50 per cent higher.

In Northern Italy the average production of a cow is 700 galls ; the average weight of the animals is 8 to 10 cwts., and the average price of hay is 4*s* to 5*s* per cwt. so that the price per gallon is

$$\frac{12 \times 9 \times 54}{700} + 25\ \% = 8.3 + 25\ \% = 10.4d.$$

In Central and Southern Italy the production is only 460 galls. the animals are larger and hay is scarce and dear, so that the cost per gallon is frequently twice as high as in the north.

## AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

319 – **Lead Arsenate in Vine Culture** (1). — MUTTELET C. G., in *Annales des Falsifications* Nos. 94 and 95, pp. 298-301. Paris, August and September 1916.

The use of arsenical insecticides, and especially of lead arsenate is on the increase among vine growers, now that their efficiency is realised. Opinions differs as to the best period for applying them ; some say it would be wiser not to treat the vines after the formation of the grapes, while others say that no satisfactory results can be obtained unless the treatment is continued until after the flowerimg is over and the seeds are formed.

It is entirely from the point of view of public safety that the question has been examined, — to see in what proportion the poisonous salts of lead, arsenic, and copper are found to exist in the produce of vines which have undergone one or other treatment.

The Central Laboratory for the Repression of Fraud has received wines from the Clos des Pins at Cournonterral in Herault, where the vines undergo an intense and prolonged treatment with arsenical insecticides. It has been the custom to give them 4 dressings between the bursting of the bud and the end of the flowering, a sixth when the grapes have attained a third of their normal size, and a seventh before the maturation of the colour. Besides the dressings with lead arsenate, the stocks were powdered with sulphosteatite containing 10 percent of copper sulphate, or with a mixture of sulphur and copper sulphate in the proportion of 9 to 1.

From the end of June 1915, till the vintage there was no rain, traces of the sixth arsenical treatment could still be seen on the leaves, and on the soil blackened by the sulphuring.

(1) See also *R.* July 1916. 795. (*Ed.*)

From the analysis of specimens the following results were obtained :

| Specimen | Appearance of specimen. | Results of analysis | | |
|---|---|---|---|---|
| | | Lead | Arsenic | Copper |
| Ordinray wine. | Liquid, red of a rich colour, limpid, no precipitate. . . . | none | Infinitesimal traces | none |
| Wine lees. . . | Liquid slightly colored, somewhat turbid, containing a great deal of precipitate (1). . . . . | none | 5 mgms. per 100 litres | faint traces |
| Coarse lees . . | Semi-fluid mass, covered with a small quantity of liquid slightly colored (2). . . . . | 500 mgms. per kilo | 10 mgms. per kilo | traces |
| Sour wine . . | Liquid, red, faintly colored, limpid, no precipitate . . . . | none | Infinitesimal traces | none |
| Marc. . . . . | Mixture of grape stalks, pulp and pips dried in the open air (3). . | 200 mgms. per kilo | 0,1 mgm. per kilo | traces |

(1) The liquid mass carefully decanted before it was analysed, but it still remained turbid.
(2) The whole mass was made homogeneous by shaking before a sample was taken.
(3) The mixture was dry enough for a specimen to be taken immediately.

From the foregoing analyses the following conclusions were drawn :

1) Ordinary and sour wines contain no poisonous salst (salts of lead, arsenic or copper) except for infinitesimal traces of the last two.

2) Wine lees, carefully decanted, but still turbid, contain no lead, but 5 mgms. of arsenic per 100 litres and faint traces of copper. It is therefore harmless.

3) The coarse lees from the grape pressing contain 500 mgms. of lead, 10 mgms. of arsenic and traces of copper per litre. These lees are dangerous.

4) The marc contains per kilo after drying in the open air, 200 mgms. of lead, 0.1 mgm. of arsenic and traces of copper. This marc cannot be used for feeding stock, either impregnated with molasses or in the dry form.

1320 – **On the Composition of Cider Brandies.** — KAYSER E., in *Bulletin de la Société des Agriculteurs de France*, pp. 262-265. Paris, October 1916.

The effect was studied on the composition of cider brandy, of the alcoholic ferments No. 153 (*Saccharomyces mali Risleri*) and of an apiculated ferment No. 158, from the collection at the fermentation Laboratory of the Agronomic Institute.

The apple must was half from Dutch apples, quarter from Locard and

a quarter from Petit Trock apples. It contained 103.5 gms. of invert sugar per litre. The must was divided between 6 round flasks, and to Nos. 5 and 6 were added 5 gms. of phosphate of ammonia and 1 gm. of acid phosphate of potassium. Nos. 1, 2, 5 and 6 flasks were sprinkled with the ferment 153, and the flasks 3 and 4 with a mixture of the ferments 153 and 158

All flasks were allowed to ferment on a vapour bath at a temperature of 26°C. Fermentation set in after 12 hours when 1,3 and 5 were removed from the bath and put in a cupboard athe temperature of the room, when fermentation was complete, the volume of the liquids was brought to what it had been at the start, and they were analysed. The results are given in

TABLE I — *Acidity of apple must (in gms. per litre).*

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Total acid. . . . . | 5.28 | 4.49 | 5.06 | 4.49 | 6.69 | 6.69 |
| Fixed acid (malic acid) . . . . . | 5.03 | 4.43 | 4.84 | 4.43 | 13.82 | 13.80 |
| Volatile acid (acetic acid) . . . . . | 0.228 | 0.052 | 0.200 | 0.052 | 0.076 | 0.086 |

The amount of acetic acid is decidedly highest in flasks 1 and 3. The changes of temperature were inimical to the ferments, and they therefore gave rise to more volatile products which Duchlaux considered attributable to the unfavourable conditions.

The distilled liquids were found to contain impurities as shown in

TABLE II. — *Impurities in distilled liquids (per* 100 cc *alcohol at* 100°).

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| | mgms. | mgms. | mgms. | mgms. | mgms. | mgms. |
| Volatile acid (acetic). | 35.10 | 9.90 | 22.40 | 19.80 | 17.00 | 26.00 |
| Aldehydes . . . . . | 106.80 | 172.20 | 120.60 | 181.80 | 150.00 | 150.00 |
| Furfurol . . . . . | 0.32 | 0.26 | 0,33 | 0.40 | 0.43 | 0.45 |
| Esters . . . . . | 72.50 | 145.40 | 117.00 | 208.90 | 78.00 | 181.10 |
| Higher alcohols. . . | 160.10 | 275.00 | 150.80 | 208.00 | 120.00 | 480.00 |
| Non alcoholic total . | 374.82 | 602.76 | 411.13 | 618.90 | 359.43 | 837.55 |

Speaking generally, it can be said that the composition of these brandies is clearly differentiated from that of brandies of industry. The proportion of aldehydes is almost the same as that of the esters, and the proportion of higher alcohols is greater than that of the esters, whereas the opposite is the case with ordinary cider brandies.

A higher temperature makes a decided increase in the proportion of aldehydes esters and higher alcohols, and diminishes the acid, as is seen by comparing flasks 1 and 2 with the ferment 153.

The addition of phosphate increases all the products, except the aldehydes, at a temperature of 26° C., as is seen with flasks 2 and 6. With flasks 1 and 5 which were subjected to the changes of temperature of the room an increase in ethers, aldehydes and higher alcohols was found.

The effect of the apiculated ferment was seen (in flasks 1 and 3) to diminish, at room temperature, the volatile acids and higher alcohols, and at a high temperature on the contrary (in flasks 2 and 4) to increase all the products except the higher alcohols.

1321 – **The Action of Different Charcoals on Sugar Solutions, and their Effect on the Analyses of Sugar Products.** — PELLET H., in *Bulletin de l'Association des Chimistes de Sucrerie et de Distillerie de France et des Colonies*, Vol. XXXIII. Nos. 10 to 12, pp. 220-227. Paris, April, May and June 1916.

For a long time it has been known that animal charcoal could absorb a certain amount of sugar and that it must therefore be used with discretion. The action of different charcoals has been studied, and their properties are tabulated below.

| | Weight per litre when dried | Percentage of water | Percentage of ash |
|---|---|---|---|
| | gms. | | |
| Ordinary animal charcoal or char, powdered. | 895 | 2 | 81 |
| Char washed with hydrochloric acid. . . . | 400 | 15 | 5.5 |
| « Flaming » char . . . . . | 567 | 23 | 50 |
| « Flandrac » char . . . . . | 280 | 15 | 7 |
| « Littoral » char . . . . . | 350 | 39 | 8 |
| « Eponite » . . . . . | 250 | 12 | 4.5 |
| Special charcoal for wines . . . . . | 405 | 4 | traces |
| A special charcoal (1) . . . . . | 310 | 6 | 1.5 |
| Charcoal from cherry stones (2) . . . . . | 573 | 1.5 | 1.5 |

(1) Charcoal of no particular quality tested because it cost about £ 1 per lb.

(2) Charcoal from A. M. PIUTTI,, director of the School of Chemistry and professor at the University of Naples. Tested because it absorbed the most gas.

The decolorizing effect was examined of these different charcoals on a solution of molasses inverted by the Clerget process, and on a liquid clarified by subacetate of lead and subsequently freed from excess of lead by sulphurous acid. The absorbent power of these charcoals was subsequently tried on a pure solution of sugar and on a solution to which acetate and subacetate of lead had been added, as well as on the solutions obtained by treating molasses with subacetate of lead as is done commercially. The following conclusions were drawn ;

1) The charcoals which can be used in the analysis of sugars have very different densities. They differ also considerably in composition, since some have 81 per cent of ash, whilst others have only traces. They have very different decolorizing power.

2) From a pure solution of sugar, they all absorb more or less sugar. This absorption is less when the sugar solution contains lead.

3) From a sclution of molasses clarified by subacetate of lead, the charcoals absorb no sugar, or only traces; some even increase polarisation to the right.

4) When a solution of molasses is analysed by Clerget's inversion process, it is found that certain charcoals cause a diminution in the sugar, whilst others have no appreciable effect. The special charcoal for decolorizing wines gives the best results.

5) This particular charcoal does not absorb the reducing substances contained in beet molasses nor in the non-fermented residue left after distilling sugar-cane molasses, but does appear to absorb non-fermented polarising substances in this residue. This sugar-cane molasses residue contains 7 to 9 per cent of reducing substances, whereas beet molasses has only 0.7 to 2.5 per cent according to the conditions of fermentation, though in special cases it may have more tham 2.5 per cent.

1322 – **Wheat Offals and their Adulteration.** — Sirot M. and Josef G., in *Annales des Falsifications*, Nos. 92-93, pp. 207-217. 4 Tables. Paris, June-July 1916.

Wheat offals have been used from time immemorial for feeding cattle;

Table I.

| Name | How obtained and description | | How Used |
|---|---|---|---|
| First Flour | First bolting, re-ground semolina, almost pure starch and gluten; the part that contains least cellulose fragments | | Kept for human consumption |
| Second Flour | "Seconds" semolina and regrindings | contain more cellulose fragments | |
| Third Flour | Regrindings | | |
| Fourth or brown flour | Remains of regrindings and sometimes siftings | | Offals kept for animal consumption |
| Mixed middlings | Remains from all grindings | contain less and less starch | |
| Bastard Middlings | From first bolting | | |
| Fine sharps | ..... | | |
| Coarse sharps | ..... | | |
| Fine, medium and coarse bran | Husks containing low percentages of starch | | |
| Germs | ..... | | |
| Stive dust | Light stuff, hair, starch, powders, dust | | |
| Siftings | Small stones, aborted grains and different seeds | | |

TABLE II. — *Composition of wheat offals (in percentage).*

| | Brown flour | Middlings | | | Sharps | | Brans | | | Germs | Stive dust | Siftings | Small grain | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | First quality | | Second quality | Fine | Ordinary | Fine | Medium | Coarse | | | | Ordinary | Assorted |
| Moisture | 12,5 | 16,3 | 10,2 | 15,2 | 13,2 | 12,0 | 15,6 | 16,0 | 13,6 | 11,5 | 9,1 | 6,9 | 13,3 | 7,0 |
| Nitrogenous substances | 14,9 | 10,5 | 14,8 | 13,8 | 12,6 | 15,5 | 15,1 | 14,7 | 11,6 | 32,2 | 6,7 | 12,7 | 11,5 | 15,4 |
| Fat | 2,7 | 1,6 | 4,5 | 2,4 | 2,4 | 4,4 | 5,8 | 3,3 | 2,3 | 7,0 | 2,1 | 3,1 | 2,2 | 2,1 |
| Nitrogen free extract | 66,4 | 67,9 | 61,8 | 61,0 | 58,2 | 54,7 | 53,2 | 52,5 | 49,8 | 43,7 | 75,2 | 34,6 | 66,6 | 69,7 |
| Cellulose | 1,7 | 2,5 | 4,8 | 4,9 | 8,2 | 6,6 | 5,4 | 8,2 | 17,0 | 1,4 | 5,4 | 8,2 | 3,0 | 2,2 |
| Ash | 1,8 | 1,2 | 3,9 | 2,7 | 5,4 | 6,8 | 4,9 | 5,3 | 5,7 | 4,2 | 1,5 | 34,5 | 3,4 | 3 1 |
| Ash insoluble in acids | — | 0,09 | — | 0,2 | — | — | 0,10 | 0,50 | — | — | — | 23,40 | 1,20 | — |
| Phosphoric acid | — | 0,51 | — | 1,15 | — | — | 2,30 | 3,20 | — | — | — | 1,01 | 0,86 | — |
| Lime | — | 0,06 | — | — | — | — | 0,26 | 0,22 | — | — | — | 4,60 | — | — |
| Nutritive value in starch. (KELLNER) | | From 75 to 60 | | | | | From 50 to 40 | | | | | | | |

their nutritive value depends on their composition, and they must therefore be chosen with care.

It was with the object of shewing farmers the composition and value of the different offals and how to recognise fraud that this investigation was made.

After rehearsing the structure of the grain of wheat and the processes it undergoes when ground, the classification of the various products are shewn in Table I.

All the offal grains were examined, and their composition is shewn in Table II. The numbers given are the mean of many analyses.

*Adulterations.* — Many commercial waste products of the same appearance as these offal wheats can be mixed with them. Brown flours and pollards are seldom adulterated ; occasionally a cheaper flour such as barley, rye, maize or rice is added, but it scarcely affects nutritive value. The same cannot be said of such heavy substances as plaster and earth, or, what is more frequently found, mill sweepings. With real brans fraud is easier. At the district laboratory of Auxene, two specimens were analysed of which one contained about 15 per cent of sawdust and the others 12 cent per cent of " rice balls ". The composition of these and of other products which lend themselves to adulteration are given in the tables.

In addition to the above, stress is laid on the changes which fermentation causes in bran even when pure. This shews itself by an increase in acidity. Ordinary bran has an acidity equivalent to about 0.15 gms. of sulphuric acid per cent. When the acidity is more than twice this, the bran should be thrown away.

*Conclusion.* — Offal wheats may be divided into two chief categories according to their nutritive value : the pollards, coarse and fine, (middlings and sharps) and real brans. These last fetch a price relatively too high, and it would be well if farmers knew to keep them for special cases, and if they sought more concentrated forms of food in the cheaper oilcakes of commerce. In any case, they cannot be too strougly urged, when buying bran, to assure themselves that it is unadulterated and in a good state of preservation.

1323 – **Investigations on the Peat Beds and the Peat Industry in Canada.** — ANREP A., *Canada Department of Mines, Mines Branch Bulletin*, No. 11, pp. 1-185. Ottawa, 1915.

The present paper is a report on the investigations on peat beds and the peat industry carried out in Eastern Canada by the Department of Mines during the years 1913-1914. Thirty one peat beds are mentioned and photographs are given of 62 species of plants which constitute the basis of beds in Eastern Canada. The utilization of peat in the United States, in Switzerland, in Norway, in Denmark and in Russia is discussed, and the plant used is described in an appendix.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS

1324 - **Sterilized Fresh Eggs.** — BLIN H., in *La Nature*, No. 2244, pp. 221-223. Paris, September 30, 1916.

The production of eggs has become an important industry in Europe and America, the principal producing countries being:

| | Annual productions Tons |
|---|---|
| United States | 800 000 |
| France | 300 000 |
| Germany | 250 000 to 270 000 |
| England | 125 000 |
| Denmark | 55 000 |

It is due to the development of cold storage that the egg trade has increased so largely in the United States. In 1911, nearly 1000 million eggs were preserved in this way, representing a value of £6 million, and during the same year Russia exported eggs to the value of £8 600 000. Such a considerable traffic has only become possible owing to the continuous improvements which are introduced in the various processes of preservation and to a strict observance of the following principles:

1) Only fresh eggs (not more than a few days old) are preserved and these are all tested before storage.

2) The passage of oxygen and of germs through the shell is prevented by avoiding the evaporation of the liquids from within the shell and the consequent production of an air space.

3) All stale or abnormal eggs are rejected, and the health and food of the birds are carefully watched.

4) No eggs are preserved in very hot or stormy weather.

At the present time various processes are currently employed for the preservation of eggs:

1) *Smearing the shells with grease.* — Paraffin, vaselin, lard, etc. may be used for the purpose, but the method is an expensive one and is only applicable for home use.

2) *Immersion in a liquid.* — Lime water, brine or waterglass may be employed, but the method is not entirely satisfactory as eggs thus preserved sometimes have a musty or lime flavour and the shells crack when put into hot water. Moreover the eggs are not sterilized.

3) *Cold storage.* — Though representing a great advance on previous processes, cold storage does not ensure perfect preservation as the low temperature does not destroy micro-organisms but merely arrests their development, so that if an egg were infected before being put into storage, it is even possible for putrefactive changes to proceed slowly at 1° C. Losses from this cause frequently amount to 5 per cent. After being stored for 4 months, an egg loses its " new laid " flavour and acquires a taste known as " stale " or " cold stored "; after 5 months the egg is no longer suitable for boiling and after 8 or 9 months its quality is approximately that of an egg preserved in lime water. As the effect of a low temperature as a preservative depends so largely on the condition of the

egg when put into store, it is of the first importance that cold storage warehouses be established in the very centres of production so that all transport of fresh eggs be minimised as possible.

4) *Sterilization in closed vessels.* — In order to preserve eggs in a perfectly fresh and wholesome condition, it is necessary to combine cold storage with a preliminary sterilization such as is practised in the Lescardé method which was making great headway in France before the war. By this method the eggs are exposed in closed vessels to an atmosphere consisting of carbon dioxide and nitrogen, and this together with a low temperature is sufficient to destroy bacteria and moulds in a short time and to ensure the subsequent preservation of eggs over a long period. Details of the process are as follows :

On arrival at the factory the eggs are unpacked and tested in order to discard all stale or cracked eggs. The testing is carried out with a simple apparatus consisting of a sheet of cardboard pierced with 168 holes each destined to hold an egg in a vertical position. The cardboard is held in a wooden frame fixed on to an empty wooden case lined with metal sheeting. There are two electric bulbs inside the case and the testing is carried out in a dark room so that it is easy to see the rays passing through the eggs and to distinguish rotten or spotted specimens. For each million eggs handled, 2 of these testers are required.

After being tested the eggs are transferred to a cooling room where they are packed into metal cases. Each case contains 6 trays and holds 1000 eggs. Cavity walls preserve the contents from bumps and an outer covering of wood facilitates the handling of the cases. As each case is filled a little calcium chloride is sprinkled inside to dry the air, and the lid is soldered on to the case, taking care that a small round hole of 5 mm. diam. is left open in the lid. The cases are loaded on to a truck and run into an autoclave very similar in construction to that used for creosoting railway sleepers. There the chamber is first exhausted to get rid all oxygen — both atmospheric and dissolved in the egg albumen and — then carbon dioxide is then run in through a coil plunged in warm water so that the intense cold of the gas as it issued from the cylinder should not crack the egg shells. When the pressure inside the chamber is equal or slightly above that of the atmosphere, the flow of carbon dioxide is stopped, the saturation of the eggs with carbon dioxide being assured as soon as the manometre becomes steady. As there might be some risk of the carbon dioxide having a solvent effect on the albumen during storage, the pressure of the gas in the autoclave is watched carefully and as soon as it goes above a certain point, carbon dioxide is pumped out and replaced by nitrogen (compressed, sterilized and cooled to 15° C.), the mixture adjusted so that it remains sufficiently antiseptic to ensure sterilization without attacking the albumen. As soon as this has been accomplished and the egg liquids are saturated with nitrogen, the autoclave is opened, the truck drawn out, and the openings in the lids of the cases are quickly sealed. A small solder plug is used for the purpose and it is coated over with a mixture of oil and grease. No danger of infiltration of air during the operation need be feared as the

carbon dioxide absorbed by the eggs is given off for some time after removal from the autoclave.

The cases, after sterilization, are stored at a low temperature (0 to 2° C.), there being no need to make any special provision for ventilation or for drying the air of the store room. On being removed from storage the cases are taken to a room heated to 20° to 25° C., and when the temperature of the eggs has reached 7° to 8° C. (the external temperature of the cases being 15° C.) the cases are opened and the eggs are packed and dispatched to market. A special advantage of the method is evident when the eggs are warmed, for it avoids all condensation of water on the surface (a frequent source of subsequent infection) and for this reason these is no immediate hurry to use the eggs after bringing them out of the store room,

Eggs which have undergone the above process are perfectly sterile; evaporation being inhibited, no loss of weight occurs; after 10 months' storage the eggs is still suitable for boiling; the air space having remained the same, no difference of any kind can be distinguished between fresh and preserved eggs when tested by light. The method has been in use in France, Italy and the United States either in special factories or in connection with ice factories.

# PLANT DISEASES

## DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1325 - **The Effect of Frost on the Roots of Rye.** — ZIMMERMANN H., in *Zeitschrift für Pflanzenkrankheiten*, Vol. 26, Nos. 6-7, pp. 321-323. Stuttgart, 1916.

In 1915 the writer observed a change in the roots of rye in fields in the Grand Duchies of Mecklenburg-Schwerin and Mecklenburg-Strelitz which was the cause of the poor yield of grain in these localities. The seed germinated fairly well in the preceding autumn, but the young shoots were feeble, probably owing to the fact that in the latter part of November they were exposed to alternate spells of warm and cold weather. The crops had also suffered from the attacks of fungi and also in certain districts from slugs.

During the winter there were alternate frosts and thaws which did the plants a good deal of harm especially between the fifth and the tenth of March. In consequence many of the plants, whose adventitious roots became loosened from the soil, withered. Almost all the plants that were not destroyed had had their roots damaged by insects during growth. Good weather would have encouraged the growth of secondary adventitious roots, but as the winter was followed by a dry spring secondary roots were not formed.

The root system that had developed formed a very scanty basis for the plant and the nutrition obtained was insufficient. The rye was therefore abnormal in its development and in many places the harvest showed only half the customary yield. The haulm and the ears were unusually small and the grains badly developed. A lot of the plants were laid so that many of the fields looked as if they had been exposed to hail storms.

Generally, but not invariably, the bad symptoms were more marked in heavy than in light soils, and in some cases at least they seemed to depend upon the previous treatment of the soil. In places were there had been much snow the damage was slight. In some localities wheat and rye-grass had also been affected.

Rolling the fields in spring has given good results even when they have been rolled in the previous autumn. The writer however recommends that they should be rolled for the second time as early as November if the plants show any bad symptoms after the first rolling. Nitrogenous manure has not proved satisfactory, except in the case of calcium nitrate which on some occasions has given fairly good results.

1326 – **The Bad Effects of Frost upon Tea and Quinine Plants in Java.** — BERNARD CH., in *Mededeelingen van het Proefstation voor Thee*, No. XXXVIII, pp. 1-11, 1 Pl. Buitenzorg, 1915.

During the night of August 30-31, 1915 a temperature of 20° F. was recorded on the plateau of Pengalengan which lies in the middle of westt ern Java at a height of 5000 feet above sea level, on the following night the temperature was again very low being 22° F. The writer describes the results that followed on this drop in temperature in the tea plantations. The young shoots turned brown and, curiously enough, lost their aroma. When the frost occurred again the young branches were killed and all the living tissues of the plants were disorganised. The effects were most disastrous in the plantations that had been weeded recently, the ' China" type and hybrid seemed to be the most resistant.

The writer suggests that the nurseries should be covered at night and that trees such as *Albizzia moluccana* and *Acacia decurrens* should be planted to provide shelter for the plantations that are exposed every year to frosts. Straw manure, etc. can scarcely be used on large estates.

*Cinchona succirubra* suffers in the same way from frost, while *C. Ledgeriana* is more resistant.

## DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

GENERALITIES.

1327 – **New or Interesting Fungi Occurring in England.** – GROVE W. B., in *The Journal of Botany British and Foreign*, Vol. LIV No. 643, pp. 185-193 ; No. 644, pp. 217-223, Pl. 542-543. London, 1916.

This paper contains a continuation of the writer's previous list of interesting fungi gathered in various parts of England. At present the complete list comprises 252 species or varieties.

In the present contribution which is the fifth of its kind, 40 species are recorded including the following :

1) *Diaporthe stictostoma* Sacc. on apple branches at Bristol.
2) *Phoma Lavandulae* Gab. on the stems of lavender at Kew Gardens (1).
3) *Fusicoccum Aceris* n. sp. on maple branches in Cheshire.
4) *F gloeosporioides* Sacc. and Roum. on *Corylus Avellana* in Cheshire.
5) *F. quercinum* Sacc. on the branches of oak near Malvern.
6) *Cytospora stictostoma* n. sp. occurring with *Diaporthe stictostoma* on the branches of apple trees at Bristol.

(1) See *R.* October 1916, No. 1133. (*Ed.*)

7) *Ceuthospora Euonymi* n. sp. on the leaves and branches of *Euonymus japonicus* at Wallasey (Cheshire) and at Southampton.

8) *Asochyta Vincae* n. sp. on the leaves of *Vinca major* at Ledbury.

9) *Diplodina Passerini* Allesh. at the stem bases in *Antirrhinum* at Birmingham.

10) *Septoria oxyspora* Penz. and Sacc. var. *culmorum* n. var. on the stalks of *Dactylis glomerata* at Burcot near Bromsgrove (Worcestershire); it occurs with *Leptosphaeria microscopica* and a *Physalospora* (?).

11) *Camarosporium rubicolum* Sacc. on the stems of *Rubus* at Shustoke and on the young branches of *R. discolor* in Herefordshire.

11) *Colletotrichum Lineola* Corda on *Dactylis* at Olton.

13) *Leptothyrium platanoidis* Pass. on the leaves and on young plants of *Acer Pseudoplatanus* at Park-Mill, Gower-Peninsula and at Himley-Park, Staffordshire; this fungus is a serious pest on young plants.

14) *Ramularia sambucina* Sacc. on the leaf segments of *Sambucus nigra* at Studley Castle.

15) *Hormiscium calisporum* Grove on the stems of of *Conium maculatum* at Hereford.

1328 – **On Specialisation in Parasitic Fungi with Special Reference to the Specialisation of Rust on Cereals.** — MONTEMARTINI L., in *Rivista di Patologia vegetale*, Year VIII, No. 2, pp. 33-44 ; No. 6-7, pp. 145-158. Pavia, 1906

By the " specialisation " of species of fungi which are well characterised morphologically and which are shown to be parasitic on many plants is meant their particular adaptation and fixation to different hosts so as to form sub-species (also known as specialised species, biological species or sister species). They are distinguished from one another by physiological characters, such as their ability to attack one or several species, or even a group of species among the plant hosts.

What is the value of these specialised forms ? Are they really fixed ? Are they distinct units capable of passing from one region to another, or should they be looked upon as local forms due to the variability or the distribution of the various plant hosts ?

From observations which have been collected in various parts of the world doubt has been cast upon their stability and the suggestion has been put forward that they are, rather, local adaptive forms, probably temporary, which owe their origin to the various nutritive conditions which are offered to them by the different plant hosts. The suspicion has also arisen that sometimes the localisation on one or another of the plant hosts may be due to the different conditions and different degrees of development of the hosts themselves and to the degree of their susceptibility, which varies with these differences.

The observations of a number of writers on the rust of cereals shows that when a given cereal develops late or in any unseasonable manner it cannot offer any resistance to the invasion of the parasite, which normally appears to be localised and fixed on a different plant host. The fact cannot be ignored that in some cases, because of the impossibility of migrating to another host, a pleophagous parasite can become definitely monophagous. Nevertheless the above mentioned facts lead to the conclusion that in the greater number of cases (and perhaps it is so in the case of rust) the species remains pleophagous and only localises and spreads itself in a specialised manner on the host or hosts which every year offer it the most

suitable conditions for propagation and growth. However the species is always capable of passing on to other plant hosts when they are in a condition rendering them liable to attack, so that it is not certain that the danger of infection between two different cereals has disappeared; it can only have diminished, on the one hand by the rotation of crops by which the different species are never at the same time in the stage at which they are most susceptible, on the other by the facility with which the parasite adapts itself to a certain food and changes it with difficulty. In spite of this the danger would always be great for plants developing late or out of season because of the presence of what are know as "transition species" ("specie ponti") which possibly offer the parasite an intermediate food between that supplied by the old plant host and the new. It is thus clear that fungi, even parasitic ones, are very sensitive to the chemical composition of their nutrition.

The writer's researches on *Alternaria Camelliae* (Cooke and Mass.) Montem. show that fungi are very sensitive to the chemical composition of the substances in which they live, and that under the influence of food they easily acquire certain definite adaptive characters.

Judging by the writer's experiments with various species such as *Oidium quercinum* Thum., *O. leucoconium* Desm., *Aecidium Violae* Schm., *Phragmidium subcorticium* (Schr.) Wint., *Puccinia Malvacearum* Mont., *P. coronata* Corda of oats, *P. graminis* Pers. of wheat, rye and *Agrostis*, a like sensitiveness is also seen with regard to the different foods which parasitic fungi can extract from the plants which they attack in the case of pleophagous fungi, or from the different organs or parts of an organ of one plant in the case of monophagous fungi, or even from the different stages of development of the infected organ itself. Among other things this sensitiveness appears in differences in germination, and in the virulence of the spores which are produced under these different conditions.

Rust of cereals, or at any rate *Puccinia Rubigo-vera* D. C. f. *Secalis* Erikss., which the writer studied specially during 1916 in the Botanical Garden at Pavia, can pass on to various of the cereals examined — winter corn, spring corn and oats — and the sensitiveness of the plants as regards this fungus varies with their age, but not uniformly for each species of cereal so that the period of maximum sensibility does not always fall at the same stage of development in each species. All these factors may account for the fact that a given cereal is badly attacked in some years while in others it is perfectly healthy, or vice-versa, according to whether in the rotation of crops this species or that species is passing through its most sensitive period at the time when the spores of the fungus coming from other infected crops are most abundant. The phenomenon may be complicated in two ways: first by the action of the atmospheric conditions on the degree of susceptibility of the plant and also on the virulence of the uredospores, and in the second place by the action of the plant host or of its organs in which the uredospores originate, which may have acquired peculiar properties or adaptations.

In any case there is reason to doubt whether in Italy at least the so-

called specialised forms are really fixed, and the evidence points to their being rather adaptive forms due to the parallel development of the host and the parasite.

1329 - **Researches upon *Peronospora parasitica* a Pest on Cruciferous Plants.** — GAUMANN E., in *Centralblatt für Bakteriologie, Parsitenkunde und Infectionskrankheiten*, Vol. 45, Nos. 18-25, pp. 575-577. Jena, 1916.

Athough to judge from their frequent occurrence the *Peronosporales* are the most widely distributed group of Fungi, our knowledge of the different species is still in a chaotic state. The writer has therefore experimented with *Peronospora parasitica*, which is parasitic on cruciferous plants, and has found that specialisation is carried to a very high degree. For instance the species that grows on *Capsella* cannot be transmitted to other plants, nor can the species that grows on *Brassica*. In some cases the plant host is restricted to a single species in others to two or more species belonging to the same genus; thus the variety of fungus which attacks *Sisymbrium officinale* cannot infect *S. Sophia*, while *P. parasitica* will attack *Brassica oleracea* and *B. Rapa*.

To obtain further information on these points numerous forms were examined from the morphological standpoint, comparisons being made between the oospores, the conidia and the conidiophores. Taking the size of the conidia as the fundamental point, the varieties of *P. parasitica* form a continuous line comparable with those described by MULLER (1907) and SCHMIDT (1913) for the teleutospores of *Melampsora*, parasitic on *Euphorbia*, and the conidia of *Erysiphe Polygoni* respectively. There are even some cases in which differences occur when the host plants are of the same family, for example, in *Arabis, Cardamine, Nasturtium* and *Sisymbrium* the differentiation of the conidiophores is even greater.

These experiments prove that the specialisation of *P. parasitica* on hosts of the same family is, if possible, greater than it is in many of the *Uredinales*.

1330 - **Patents Concerning Preventive Measures against Plant Diseases and Pests.** — See No. 1310 of this *Review*.

1331 - **On the Appearance of Cryptogamic Diseases in Soils Cultivated with Potatoes for the First Time and Sown with Healthy Tubers.** — PRATT O. A., in *Journal of Agricultural Research*, Vol. VI, No. 15, pp. 573-575. Washington, D. C., 1916.

It has generally been assumed by plant pathologists that if disease free potatoes are planted on new land the resulting product will be free from disease.

The irrigation works which have been carried out in southern Idaho have brought large tracts of virgin soil under cultivation, but contrary to all expectation the potato crop even in the these regions is anything but free from disease. Wilt (*Fusarium oxysporum* Schlerct.) blackrot (*F. radicicola* Wollenw.), jelly-end rot (*Fusarium* sp.), russet scab (*Rhizoctonia*), powdery dryrot (*F. trichothecioides* Wollenw.) and common scab (*Actinomyces chromogenus* Gasperini) are all of common occurrence.

The writer has obtained interesting results by planting potatoes in absolutely virgin soil and on land which had been planted before with barley and lucerne; all these experiments were carried out in Idaho. The results of these experiments are summarised in the adjoining Table.

| | Percentage of plants infected | |
|---|---|---|
| | on virgin soil | on soil previously planted with barley and lucerne |
| *Actinomyces chromogenus* . . . . . | 9.3 | 4.7 |
| *Rhizoctonia* . . . . . | 11.6 | less than 2.8 |
| *Fusarium* spp. . . . . | 5.6 | » » .5 |
| vascular infection . . . . . | 29.3 | 26.0 |

The following conclusions are drawn from the results obtained from these experiments:

1) Planting clean seed potatoes on new land does not guarantee a disease-free product.

2) A smaller percentage of disease may appear in the product when clean tubers are planted on land which has been sown with barley and lucerne than when similar tubers are planted on virgin soil.

1332 – **Storage-Rots of Economic Aroids.** — HARTER L. L., in *Journal of Agricultural Research*, Vol. VI, No. 15, pp. 549-571, Fig. 1, Pl. LXXXI-LXXXIII. Washington, D. C. 1916.

*Colocasia esculenta, C. indica, Alocasia* sp. and *Xanthosoma sagittifolium* among aroids are largely cultivated in tropical and sub-tropical regions for the sake of their tubers and aerial organs which are used for food, they have now been introduced into the United States where they are becoming of great economic importance. The diseases that attack these plants are therefore of considerable interest. The corms and tubers are stored in piles in the fields, being protected from frost by coverings of straw and earth; if these piles are not properly ventilated their contents are attacked by various forms of rot to such an extent that they are often rendered unfit for food. Four kinds of rot can be distinguished: 1) Java black-rot which is caused by different species of *Diplodia;* 2) powdery gray-rot, caused by *Fusarium Solani;* 3) Sclerotium-rot, caused by *Sclerotium Rolfsii*; 4) soft-rot, caused by *Bacillus carotovorus.*

*Java black-rot* — When the tissues are first invaded by the fungus there is very little change in colour but the substances of the tuber or corm becomes soft and pasty, a little later on the diseased parts turn faintly pink and become much firmer owing to the loss of moisture. The rot progresses slowly. The first symptoms appear about 7 days after inoculation, but any time, rom 4 to 8 weeks, may elapsebefore the tissues are

completely blackened. The middle lamella is dissolved and later the hyphae of the parasite penetrate the cell walls and bury themselves among the starch grains. Eventually the whole cellular structure is converted into a disorganised, powdery mass. Cultures of the following forms were used for the inoculation experiments which always gave positive results: 1) *Diplodia tubericola* isolated from infected plants belonging to the genus *Colocasia;* 2) *D. tubericola* from *Ipomoea Batatas;* 3) *D. Maclurae* from a branch of *Toxylon pomiferum;* 4) *D. gossypina* from cotton plants; 5) *Diplodia* sp. from a specimen of *Mangifera indica* from Cuba. All the species of *Diplodia* give rise to the same type of rot. The results of the inoculation experiments are given below.

| | *Colocasia esculenta* | | *Xanthosoma sagittifolium* | | *Colocasia indica* | | *Alocasia* sp. | |
|---|---|---|---|---|---|---|---|---|
| | Inoculation | Infection | Inoculation | Infection | Inoculation | Infection | Inoculation | Infection |
| *D. tubericola* from *Colocasia* | 36 | 29 | 5 | 5 | 4 | 4 | 5 | 5 |
| *D. tubericola* from *Ipomoea* | 14 | 9 | 11 | 9 | 5 | 5 | 5 | 4 |
| *D. Maclurae* | 10 | 4 | 10 | 5 | — | — | 4 | 0 |
| *D. gossypina* | 15 | 10 | 5 | 3 | — | — | 4 | 4 |
| *Diplodia* sp. from *M. indica* | 10 | 9 | — | — | — | — | — | — |

*Powdery gray-rot.* — Infection usually begins in the wounds made by breaking the corms and tubers apart, showing that it is probably strictly a wound parasite, the diseased part becomes orange in colour and eventually turn brown. The superficial tissues are attacked first and the softening extends to a depth of about ¼ or ½ an inch. On drying, the specimen shrinks and takes on a dark grey colour.

*Fusarium Solani* is the specific cause of this disease. For the inoculation experiments cultures of *Fusarium* have been used that were obtained from diseased plants of *Colocasia* and *Ipomoea Batatas.*

*Sclerotium-rot.* — The surface of a diseased tuber is covered with numerous sclerotia. The infected parts keep their shape but tend to become stringy, and finally numbers of saprophytic fungi and bacteria invade the superficial parts and they liquify and become putrid. *Sclerotium Rolfsii* is the cause of the disease as is proved by the positive results of inoculation experiments. It attacks *Lycopersicon esculentum, Arachis hypogaea, Brassica oleracea, Gossypium* sp., and *Viola* spp. indifferently.

*Soft-rot.* — Soft-rot develops in the fields as well as in the storage places. The tissues soften and acquire a very unpleasant smell although

there is no discoloration. The middle lamella is dissolved and numerous bacteria develop in the intercellular spaces. Inoculation experiments show that *Bacillus carotovorus* is the cause of the disease.

Moisture and temperature play considerable parts in all these diseases. *Fusarium Solani* is mosts dependent upon the presence of moisture as its spores will not develop unless they lie in a thin film of water therefore when artificial inoculations are made the tubers have to be moistened to start the development of the fungus. *Sclerotium Rolfsii* also requires a certain amount of moisture which is best supplied by spraying a few times with an atomizer. The various species of *Diplodia* flourish most in a dry environment.

High temperatures encourage rot to such an extent that it is advisable to keep the tubers and corms in a well ventilated place at 8° to 10° C. *Bacillus carotovorus* alone is able to produce rot at a temperature lower than 9° C.

1333 – **Diseases of Some Forage Plants in Natal, Union of South Africa.** — VAN DER BIJL P. A., in *The Agricultural Journal and Small Holder of South Africa*, Vol. IV, No. 20 pp. 37-39, Figs. 1-6. Johannesburg, 1916.

The writer records the presence of *Helminthosporium turcicum* Pass. on Soudan grass (*Sorghum vulgare* var.). This fungus has only been observed on Soudan grass in two localities in Natal and not at all in the other provinces; it has been recorded on maize however in Portuguese East Africa, in Rhodesia and in Natal. Maize and *Sorghum* are also known to be the hosts of this parasite in America and in Europe. Probably the fungus has migrated on to Soudan grass from some other plant either wild or cultivated.

Rhodes grass (*Chloris Gayana*) in Natal is attacked by *Tolyposporium Chloridis* P. Henn. and by *Epichloe* sp., *T. Chloridis* is unknown and *Epichloe* spp. is not recorded on Rhodes grass in the other provinces of the Union.

*Helminthosporium crustaceum* P. Henn. is already known to occur on forage plants in the Transvaal, in Cape Colony and in Zululand, and it is now recorded from Natal on wire grass (*Sporobolus indicus*).

*Paspalum*, especially *P. dilatatum*, is very seriously attacked by *Claviceps Paspali* S. and H. *P. virgatum* has hitherto been considered immune, but recently it has been discovered that *C. Paspali* attacks this species too. *C. Paspali* is as wide spread in Natal as it is in the Transvaal and very rigorous inspection of seeds is recommended to prevent its introduction into healthy regions.

The spores of Ustilagineae in general adhere closely to the seed and are very resistant, so that it is not advisable to feed infected fodder to cattle. In South Africa formalin (0,5 per cent) is found to be very useful for disinfecting the seeds, although sulphate of copper is also used (1 lb. in 22 gallons water).

In cases where the fungi produce their spores only on the fruits of the host plant and where the grain is not to be gathered in it is suggested that

he plants should be mown down as soon as the slightest trace of the dis-ase is seen.

334 - ***Sorosporium Simii* n. sp., a Parasite on *Sorghum halepense* in Natal.** — POLE EVANS I. B., in *The South African Journal of Science*, Vol. XII, No. II, pp. 542-543, Pl. 19. Cape Town, 1916.

Towards the end of February 1915 the writer received a parasite or examination which belonged to the order *Ustilaginales*; it had attacked he inflorescence of Johnson grass (*Sorghum halepense*). The specimen vas sent by J. M. SIMS of Maritzburg and it was found to be a new species f *Sorosporium* which the writer described under the name of *S. Simii*. t is probable that this fungus can also attack Soudan grass (*Andropogon Sorghum* var. *sudanensis*) which is very like *Sorghum halepense* except or the fact that it is an annual. The fact that *S. halepense* is a perennial uggests that the infection is not limited to the young plant springing rom the seed but that the fungus is able to infect the fully developed lant as is the case in many of the other *Gramineae*.

335 - **Diseases and Pests that Attack Pepper at Banka, Dutch Indies.** — See No 1286 of this *Review*.

336 - **Researches on Blight in Seedlings with Special Reference to those of *Brassica*.** — KROPOULOS P., in *Centralblatt für Bakteriologie, Parasitenkunde und Infectionskrank heiten*, Vol. 45, Nos. 6-12, pp. 244-256. Jena, 1916.

The writer gives a short account of the previous work that has been one on the subject of blight in seedlings and then goes on to describe his wn experiments which were carried out at the Institute of Agricultural Bacteriology at Göttingen. Different parasites can give rise to the disease; ccording to HESSE and the writer, *Pythium De Baryanum* is found as a ule on spinach, *Camelina*, *Lepidium*, *Linaria*, *Matthiola* but only rarely n cabbages. *Artotrogus hydnosporus* with hirsute oöspores only appears s a secondary saprophyte. According to DE BARY *Sclerotinia sclerotiorum* found on the young plants of *Brassica*, *Phaseolus*, *Petunia* and *Zinnia*, hile *Scl. Fuckeliana* is found by KYROPOULOS on *Zinnia elegans*; he lso records *Botrytis cinerea* from young plants of *Torenia* and *Brassica*. TOERMER and EICHINGER state that *Phoma Betae* lives on beetroots, and VORONIN has discovered *Olpidium Brassicae* on the seedlings of *Brassica*. inally STOERMER, EICHINGER and the writer all record *Moniliopsis Aderoldii* from young plants of beetroots, *Brassica* and *Raphanus Radicula*.

The present experiments show that the seedlings are attacked: 1) be-ore the first leaves have developed, in which case the young plants usually ie; 2) when several leaves are developed, in which case the hypocotyl lone is destroyed down to the fibrovascular vessels and the plant may ecover.

The fungus which has been found has a strongly developed mycelium ith numerous transverse septa. At first the protoplasm is granular and omogeneous, but later on numerous vacuoles are formed. In a damp tmosphere an aerial mycelium is produced which branches out almost at ght angles. Two types of reproductive organs are found: 1) small cells

of the *Monilia* type, wider than the mycelium and richer in plasma ; so far no one has succeeded in isolating these cells and raising the fungus from them ; 2) pseudosclerotia with a dark nucleus and a clear envelope, which are produced by the *Monilia* type of cells just described and which may be as large as a pin's head. They produce no apothecia and undergo no resting stage before giving rise to a new mycelium. The fungus found in *Brassica* is identical with *Moniliopsis Aderholdii* Ruhland which is known as « Vermehrungsschimmel » and is very greatly feared.

The most successful remedies are : to sow the seeds sparsely and to sterilise the soil with steam, or by watering it with boiling water, or by the addition of toluol.

1337 – **Citrus Canker (*Pseudomonas Citri*) in the Philippine Islands.** — (1). Wester P. J., in *The Philippine Agricultural Review*, Vol. IX, No. 2, pp. 155-157. Manila, 1916.

Citrus canker (*Pseudomonas Citri*) originally comes from the East, where it is wide spread in China, Japan, India, Ceylon and in the Malay States. It seems to have been introduced into America from Japan on *Citrus trifoliata* and it occurs in Florida, Alabama, Mississipi, Louisiana and Texas.

The writer discovered it for the first time in the Philippine Islands at the Experimental Station at Lamao in 1912, but no great harm was done until the end of the rainy season of 1914. The disease has been recorded also at Bulusan and at Barcelona (Sorsogon), in the province of Tayabas and at Laguna and Batangas ; it occurs on the following species of *Citrus* : *C. macrophylla* (alemow) ; *C. micrantha* (biasong) ; *C. Webberii* var. *montana* (cabugao) ; *C. Hystrix* (cabuyao) : *C. mitis* (calamondin); *C. Webberii* (calpi); *C. Hystrix* var. *boholensis* (canci); *C. Hystrix* var. *torosa* (colobot) ; *C. pseudolimonum* (colo-colo) ; lemon (*C. Limonum*) ; *C. Southwickii* (limao) ; *C. limetta* and its variety *aromatica* ; *C. excelsa* and its variety *davaoensis* (limon real) ; mandarine (*C. nobilis*) ; orange (*C. Aurantium*) ; pomelo (*C. decumana*) ; *C. micrantha* var. *microcarpa* (samuyao) ; *C. vulgaris* (sour orange) ; *Aegle glutinosa* (taboc) ; *C. longispina* (talamisan) ; *C. nobilis* var. *papillaris* (tizon) and *C. trifoliata*.

The least susceptible species, which proved in fact to be almost immune, were *C. nobilis*, *C. nobilis* var. *papillaris*, *C. mitis*, *C. Webberii* var. *montana*, on the other hand *C. pseudolimonum*, *C. Limetta* var. *aromatica*, *C. longispina*, *C. excelsa* var. *davaoensis* and *C. Webberii* are all very susceptible to the infection especially in the first stages of growth, that is when the plants are still in the nurseries. *C. Aurantium* and *C. decumana* are very variable in their resistance to this disease.

The following preventive methods have been successfully used : 1) applications of formaldehyde once in every ten days ; in the proportion of 1 part of formaldehyde to 20 parts of water ; 2) extensive pruning to suppress all the leaves and branches that show any trace of the disease.

(1) See also *R.* July 1915, No. 763. (*Ed.*).

1338 - **Diseases that Attack Vines in Ontario, Canada.** — See No. 1350 of this *Review*.

## WEEDS AND PARASITIC FLOWERING PLANTS.

1339 - ***Xanthium canadense*, a New Weed in Southern Australia.** — *The Journal of the Department of Agriculture of South Australia*, Vol. XIX, No. 10, pp. 898-900, 1 Fig. Adelaide 1916.

*Xanthium canadense* Mill. which is a weed of American origin has appeared at Renmark near the Murray whence it threatens to spread into the adjoining regions. The proper authorities have however taken energetic measures to destroy this plant before its seeds can ripen, a precaution which is very necessary as during the floods the seeds would readily be disseminated into all the low lying regions bordering on the Murray.

1340 - ***Echium vulgare* and *Phytolacca octandra* Harmful Weeds in New Zealand.** (1) — ATKINSON E., in *New Zealand Department of Agriculture, Industries and Commerce, The Journal of Agriculture*, Vol. XII, No. 5, pp. 381-385, 2 Figs. Wellington, 1916.

A description of viper's bugloss (*Echium vulgare* L.) which is very wide spread in New Zealand and more especially in the province of Marlborough where it invades pastures whose soil is dry and light. Cattle refuse to touch this weed. An account of inkweed (*Phytolacca octandra* L.) is also given. This weed predominates in the north and is one of the most important in the province of Auckland. Its dispersal is undoubtedly effected by birds which eat the fruits and drop the undamaged seeds with their excreta.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

### GENERALITIES.

1341 - **Locusts in Java.** — ROEPKE W., in *Teysmannia*, Year 26, Nos. 1-2, 6-7 and 12, pp. 115-124 337-358 and 758-790, 2 Figs., 7 pl. Batavia, 1915.

The writer gives a brief account of the occurrence of locusts in various countries, and refers to his observations on the recent appearance of these insects in the island of Java.

Almost all the locusts found in Java belong to a species which is also found in the British Indies, *Cyrtacanthacris nigricornis* (*Acridium melanocorne*). They infested the coffee plantations in the middle of Java about 30 years ago, and appeared again in 1897 in this and in other regions, and finally at the beginning of 1915 they invaded the island again their chief objective being the teak forests (*Tectona grandis*) in the middle of the island ; several places in the east were also attacked but to a less extent.

The pest reaches its maximum towards the end of the rainy season and disappears at the end of the hot weather (which lasts nearly 6 months). Climatic conditions have a good deal to do with the appearance of the locusts and the writer believes that they are most likely to occur in years when the rainfall is below the average. He has found several kinds of locusts

(1) See also *R.* March 1916, No 363 ; *R.* July 1916, No. 821 ; *R.* August 1916, No. 944. (*Ed.*)

but of these *C. nigricornis* is the only one that is harmful. Unlike the European and African locusts this species does not travel over very great distances.

The foliage at the tops of the trees is first attacked, and then the insects spread to the other leaves. They show a decided preference for maize, cocoa-trees, *Castilloa* and *Artocarpus incisa*, but failing these, other plants are attacked ; rice and other cereals, with the exception of maize, are not however damaged.

The writer has discovered a fungus which kills these locusts wholesale; it has been identified as *Metarrhizium Anisopliae* and it is prevalent during the rains and attacks the adult insects principally. Among other natural enemies are *Mylabris postulata* and *Scelio javanica* which destroy large numbers of eggs.

Finally the preventive measures in use in Europe and Africa are described, but the writer believes that in Java the locusts will be exterminated more effectually by their natural enemies than by artificial means.

MEANS OF PREVENTION AND CONTROL

1342 - **Studies Concerning the Application of Hydrocyanic Acid as an Insecticide.** (1) — Stone G. E., in *Journal of the New York Botanical Garden*, Vol. XVII, No. 199, pp. 97-103. New York, 1916.

Hydrocyanic acid, which is so extensively used for fumigating insect pests, possesses the disadvantage of burning the leaves and flowers of the plants on which it is employed. In this paper the writer shows that the sensitiveness of the plant towards the action of the gas varies however, even at the same stage of development, according to the conditions of light and moisture which have acted upon the different organs during their growth.

Five patches of pumpkins were used for the work on light intensity, the first four being covered with canvas shades so that the intensity of the light falling upon them could easily be regulated. In the fifth the plants were exposed to the ordinary light of the greenhouse which was reckoned as having an intensity of 100. The development and the form of the vegetative parts in the several groups varied considerably as is shown in Table I.

Table I. *The effect of light intensity upon growth (measurements given in cms).*

| | Series | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Relative light intensity | 24.00 | 26.00 | 48.00 | 74.00 | 100.00 |
| Average height of plants | 22.30 | 23.30 | 17.30 | 19.90 | 15.50 |
| Average diameter of petiole | 0.44 | 0.53 | 0.53 | 0.66 | 0.78 |
| Average length of internodes | 17.30 | 7.00 | 5.90 | 4.30 | 4.00 |
| Average length and breadth of leaves | 70.90 | 90.30 | 62.60 | 80.20 | 85.50 |

(1) See also B. June 1911, Nos. 1966-1967 ; B. July 1911, No. 2340 ; B. June 1913, No. 765 ; B. February 1914, No. 191 ; B. June 1914, No. 587. (*Ed.*)

The sensitiveness of the plants to the action of the acid varies inversely with the light intensity. The leaves in the first series, which developed under unfavourable lighting conditions, were badly burnt, sometimes being killed outright, while those of the fifth series, under normal conditions were only slightly damaged.

The effects of the soil humidity were equally clear but in this case increase of humidity was accompanied by an increase in the sensibility of the plant to the action of the acid, in spite of the fact that the vegetative parts are much more developed (See Table II).

TABLE II. — *The effect of soil moisture upon growth (measurements given in cms).*

| | Series | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Soil moisture per cent | 10.00 | 15.00 | 20.00 | 50.00 | 60.00 | 70.00 |
| Average height of plants | 6.20 | 7.50 | 10.20 | 13.00 | 17.50 | 21.20 |
| Average length of internodes | 4.20 | 4.50 | 5.20 | 5.50 | 7.50 | 8.20 |
| Average length of petioles | 1.30 | 1.70 | 2.20 | 3.20 | 4.00 | 3.20 |
| Average diameter of petioles | 0.30 | 0.30 | 0.40 | 0.45 | 0.55 | 0.50 |
| Average length and breadth of leaves | 6.25 | 39.50 | 67.50 | 162.50 | 225.00 | 285.00 |

The plants belonging to the sixth series which were the most succulent and vigorous were also injured the most by the acid. The same vegetative organs at exactly the same stages of development can exhibit very different degrees of resistance according as their development has been influenced principally by the light intensity or by the soil humidity, and both these factors are apt to vary even in restricted limits of time and space.

From these considerations several useful suggestions arise as to the time at which fumigation should be practised and the method which should be used. Excessive moisture in the air has the same effect upon the tissues as a high moisture content in the soil, that is, the cells become turgid with very thin walls, so that the acid should not be applied in damp or rainy weather. In such cases it is advisable to wait until 4 or 5 sunny days have increased the resistance of the cells and then to choose a starlight night without a moon when the functional activities of the leaves are at their lowest so that the tissues are less sensitive to the action of the gas.

1343 - **Experiments Concerning the Destruction of *Lepidiota albohirta*, a Coleopteran Pest on the Sugar Cane in Queensland.** — JARVIS E., in *Queensland Bureau of Sugar Experiment Stations, Division of Entomology, Bulletin* No. 4, pp. 1-14, 1 Pl. Brisbane. 1916.

In this paper the writer gives an account of the results which he obtained from a series of experiments carried out with a view to finding some cheap and efficacious means of destroying the larvae of the grey-back

beetle (*Lepidiota albohirta* Water.). These larvae do a great deal of damage in sugar cane plantations by boring into the rhizomes ; they are characterised 1) by their extreme voracity ; 2) by their habit of swallowing a large amount of earth which passes unchanged through the body. These two features at once suggest the possibility of killing the insects by poisoning the soil in which they live. The writer has made numerous attempts of this kind using various substances, but wholly satisfactory results have only been obtained with Paris green mixed with damp soil in the proportion of about ½ lb. to a cubic yard of soil.

Such an operation is too costly for practical use in addition to the fact that it presents serious difficulties of manipulation. Better results can however be obtained by mixing the earth with poisonous vegetable products, such as the leaves of the Mauritius bean or of the cow pea (*Vigna Catjang*). These plants also have the advantage of acting as manure. The leaves are treated with a mixture of sugar and water (1 part of sugar to 3 parts of water) and then they are watered with a solution of Paris green and mixed into the soil. Experiments conducted on these lines give entirely positive results : out of 17 larvae, 10 were dead at the end of the first day, and the mortality reached 100 per cent a fortnight later. The poisoned leaves of the cow pea have the great advantage of remaining poisonous and attracting the larvae even when they have been in the ground for a month and are nearly decomposed.

Field experiments have not yet been tried. The writer suggests that one of the leguminous plants mentioned should be sown along the lines of sugar canes, and that it should be buried in the ground after spraying it with Paris green from an ordinary sprayer.

The results of comparative experiments using Paris green and arsenious anhydride are given below.

Paris green :

| | | |
|---|---|---|
| Larvae killed by the end of the first week . . . . . | 58 | per cent |
| " " " " " " second " . . . . . | 75 | per cent |
| " " " " " " third " . . . . . | 91.60 | per cent |

Arsenious anhydride :

| | | |
|---|---|---|
| Larvae killed by the end of the first week . . . . . | 16 | per cent |
| " " " " " " second " . . . . . | 25 | per cent |
| " " " " " " third " . . . . . | 33.30 | per cent |

The mortality when arsenious anhydride is used is certainly inferior and as the cost is six times as great as that of Paris green the latter is to be preferred.

INSECTS, ETC. INJURIOUS TO VARIOUS CROPS

1344 – ***Xanthorhoe praefectata*, a Pest on New Zealand Flax (*Phormium tenax*) in New Zealand.** — MILLER D., in *New Zealand Department of Agriculture, Industries and Commerce, The Journal of Agriculture*, Vol. XII, No. 6, pp. 446-451. Wellington, 1916.

The larvae of the New Zealand Flax grub (*Xanthorhoe praefectata*) attack *Phormium tenax* in New Zealand, but no great harm is done except in the region of the Makerua Swamp. These larvae dislike sunlight, and in consequence spend the day at the base of the plant host in hiding among

the dead leaves and other vegetable refuse only emerging during the night. Although they can live in very varied situations they prefer marshy soils probably because these offer the most favourable conditions for their later development.

The number of these parasites is greatly reduced by the birds that haunt the marshes and further work will doubtless lead to some efficacious method of exterminating the pest.

1345 - ***Aphis pseudobrassicae* a Pest on *Brassica* and *Raphanus* spp. in America.** — DAVIS J. J. and SATTERTHWAIT A. F., in *Purdue University, Agricultural Experimental Station, Bulletin* No. 185, Vol. XVIII, pp. 915-940, Figs. 1-7. Lafayette, Indiana, 1916.

*Aphis pseudobrassicae* Davis (false cabbage aphis or turnip plant louse) is very wide spread in North America, having been reported from the following localities : Walnut-creek, California ; Fort-Collins, Colorado ; Gainsville, Florida ; Evansville, Goshen and Lafayette, Indiana ; Wellington, Kansas ; Forest-Hills, Massachusetts ; Greenwood, Mississipi ; Geneva, New-York ; Salem, Ohio ; College Station, Texas ; Madison, Wisconsin ; Treesbank, Manitoba ; and Orono, Maine. This insect is also know at Pretoria in South Africa.

It attacks cruciferous plants exclusively and undoubtedly much of the damage attributed in the past to *A. brassicae* has really been caused by this species. The two species differ widely, as *A. pseudobrassicae* has dorsal reticulate areola and also the winged females possess sense organs which lie in the fourth antennal segment.

The following host plants are enumerated : *Brassica Rapa, Rhaphanus sativus, B. oleracea, B. oleracea acephala, Brassica* sp. (mustard), *Brassica* sp. (wild-mustard), *B. nigra, B. Napus, R. Raphanistrum, Matthiola, Capsella Bursa-pastoris.*

Among the natural enemies of this parasite are : *Diaretus rapae* Curt., *Pachyneuron micans* Howard, *Aphidoletes* sp. and also a fungus, which is probably *Empusa Aphidis.*

The writer suggests the following preventive methods : 1) applications of a dilute extract of tobacco mixed with soap-suds, the insecticide must actually come into contact with the insects which are usually to be found on the under surfaces of the leaves ; 2) fumigation with prussic acid which is obtained from sulphuric acid and sodium or potassium cyanide. Great care must be taken in using this substance owing to its highly poisonous properties.

1346 - ***Cholus cattleyae* n. sp. and *Diorymellus laevimargo* n. sp., Curculionid Pests of Orchids in America.** — CHAMPION G. C., in *Entomologist's Monthly Magazine*, Vol. III, Series 3, No. 21 (No. 628), pp. 200-202. London, 1916.

A description of two new species of Curculionids belonging to the genera *Cholus* and *Diorymellus*, which have occurred as pests in a greenhouse in Bergen County (New-Jersey) on orchids from Brasil, Colombia, Central America, etc.

*Cholus cattleyae* has been observed on *Cattleya gigas* where it attacks

not only the aerial parts but also the underground organs. It its characters this insect approaches *C. forbesi* Pasc. which was bred in London on an orchid from Ecuador, and also *C. nigronotatus* and *C. nigromaculatus* Champ. both of which are found in Nicaragua and Panama. The same species has been recorded from an orchid house at Milwaukee (Wisconsin).

*Diorymellus laevimargo* lives on the flowers of *Cattleya*, it will also attack the flowers of *Dendrobium* and it is recorded from a greenhouse at Ithaca (New-York) as a pest on the hypogeal parts of orchids. This species resembles *D. 12-striatus* Champ. from Panama in its characters.

1347 - ***Aleurocanthus woglumi*, a Hemipteran Pest on Several Cultivated Plants in the Island of Cuba.** — JOHNSTON J. R. and CARDIN P., in *Modern Cuba-Cuba Moderna*, Vol. 4 (8), No. 6, pp. 8-11. Havana, Cuba, 1916 :

*Aleurocanthus woglumi* is recorded from several species of *Citrus*, coffee, mangoes and other plants in the country surrounding Guantanamo (Cuba). A description of the insect is given.

1348 - ***Idiocerus niveosparsus* and *I. clypealis*, Rhyncota Parasitic on Mango Trees in the Philippines.** — WESTER P. J., in *The Philippine Agricultural Review*, Vol. IX, No. 2, pp. 159-160. Manilla, 1916.

Every year a great deal of damage is caused to mango trees by *Idiocerus niveosparsus* and by the mango-hopper (*I. clypealis*), and in some seasons the whole crop of fruits is destroyed.

The females lay their eggs on the delicate leaves or in the inflorescence, and pierce the tissues to get at the juice, so that the young flowers and leaves eventually drop off. There are several generations every year, the most important appearing during the flowering season of the tree.

As a means of prevention it is suggested that emulsion of crude oil and of train oil should be applied until the fruits are too fully developed to be injured by the insect's attacks ; the applications however must be renewed every ten days.

1349 - ***Lygus spinolae* and *L. pratensis*, Rhyncote Pests on Vines in Austria.** — FULMEK LEOPOLD, in *Zeitschrift für Pflanzenkrankheiten*, Vol. 26, Nos. 6-7, pp. 323-319. Stuttgart 1916.

In 1914 the writer received larvae and adults of one of the Rhyncota which had done a great deal of damage in the spring in the vineyards in the south of the Tyrol. The specimens were sent by Dr. ORSI of the School of Agriculture at San Michele, and were identified by MIESTINGER as *Lygus spinolae* Mg. At the same times similar specimens were received from a vineyard near Ligist (Styria) with the information that the shoots damaged by the insects were retarded in their growth and the flowers often dropped off. At the end of April 1916 the writer receiveed again from the vine growing country round Ligist some damaged vine canes containing several young larvae. A little later on some adults of *Lygus pratensis*, a widely distributed species, were received from the same district. From the detailed report furnished by the sender it appears that the Ligist district has suffered in this way since 1897, but that the parasite had not been marked down as the cause of the mischief until 1912. The young

shoots and flowers in this region are often completely destroyed, not only here and there but on all the plants in quite large areas. It has been proved that the parasite for choice attacks well manured vineyards during the first or second year after the manure has been applied.

At the end of April 1916 the writer examined vine shoots and found among the young leaves which were still unfurled very numerous larvae, yellowish-green in colour, and hardly more than 1 mm. long and extremely active. The leaves which had developed showed numerous brown hollows in the dried up tissues, usually arranged end to end between the chief veins. In the leaves which were most severely injured the whole surface was yellow, the discoloration spreading from the edges towards the middle. The wounds occurred regularly and almost exclusively on the upper surfaces of the hairy young leaves; under a microscope the spots were seen to be hollows in the leaf tissue. The older patches were surrounded by a wrinkled brown region and the hole itself had often pierced the leaf right through; these perforations became larger and larger as the leaves grew.

When older leaves were attacked by the insects they became more or less wrinkled, while the younger leaves were completely withered. If they were not too severely attacked the more advanced leaves occasionally became almost normal in appearance in the course of the summer, but they could always be recognised by the brown lines and scars mentioned above. When the writer examined older shoots in the Ligist district at the end of May they only bore injured leaves at the upper ends while those at the bases were normal.

At the end of April there were generally several larvae hardly 1 mm. long on every shoot. In colour these were a clear greenish-yellow and on the under surface of the body between the legs was a rostrum which could be extended, and which terminated in a sharp point. With this rostrum the insect pierced the delicate tissues of the plant and sucked out the juice. At the beginning of larval life the legs and the antennae of the insect are very long as compared with the compact body; during the course of development there are several moults.

The adult insect varies in colour from a grey-brown to a greenish-grey mottled with dark or reddish brown. The colour and pattern of the winged insects is very variable. The most distinctive characters are: the size of the body which lies between 5 mm. and 6 ½ mm., the black outer edge to the anterior pair of wings, the relatively short antennae and the presence of two or three dark rings which are usually found on the posterior legs.

The habits of this new pest are too imperfectly known to allow of the adoption of preventive measures. Very often the winged spring form of *Lygus pratensis* is found in autumn on herbs and low-growing plants in fields and gardens or by roadsides and in clearings. According to Reh this insect often emigrates on to lucerne, beetroot, potatoes, hops, tobacco, cabbages, cucumbers, celery, maize, wheat, fruit trees, strawberries and flowering plants, which are damaged by its sucking out the

sap. This emigration is analogous with that of *Calocoris fulvomaculatus* which lives originally on shrubs and low growing plants and which sometimes injures hops quite severely. Just as the hop has several enemies, in addition to *C. fulvomaculatus*, *C. norvegicus*, *Lygus spinolae* and *Adelphocoris vandalicus* which emigrate on to it, so the vine is attacked by more than one species of field Hemiptera, the minimum number being two, namely: *L. pratensis* and *L. spinolae*.

It is not yet certain that spraying the vines with insecticides will serve to protect them againsts the larvae of *Lygus* which are very tenacious of life. Dufour's remedy (2 ¼ lbs. insecticide 6 ½ lbs. soft soap and 22 gallons of water) or 1-1 ½ parts of tobacco extract mixed with a 1 per cent solution of soft soap, seem to be the most satisfactory liquids for destroying the parasites when the larvae are most numerous. The most important precaution to adopt is the destruction of anything which can afford the insects shelter in the winter (burning dead leaves etc.).

1350 – **Plant and Animal Pests on the Vine in Ontario, Canada.** — CAESAR L. and HOWITT J. E., in *Ontario Department of Agriculture, Fruit Branch Bulletin* 237, pp. 39-48, Fig. Toronto, Ontario, 1916.

The first of the joint authors of this paper treats of the insects which attack the vine in Ontario, giving brief descriptions of them and suggesting appropriate preventive measures to be adopted against them.

The most important of these insects are: the grape-leaf hopper (*Typhlocyba comes*), the grape-vine flea-beetle (*Haltica chalybea*) and the rose-chafer or rose-bug (*Macrodactylus subspinosus*). None of these insects is invariably to be found in every vineyard in the province, their attacks are local and often separated by long intervals.

Among the less important animal pests are the following: the grape berry moth (*Polychrosis viteana*), the grape root-worm (*Fidia viticida*) and the grape plume moth (*Oxyptilus periscelidactylus*).

The second section of the paper deals with the diseases to which the vines in Ontario are subject.

Almost all the common diseases have been recorded from the vineyards in the province, but happily, it is very rare for any one of them to occasion serious losses over large tracts of land. However there have been serious epidemics of black-rot (*Guignardia Bidwellii*) and frequent local attacks of mildew (*Plasmopara viticola*) and of oidium (*Uncinula necator*). In addition to these three diseases the writer also describes anthracnose (*Gloeosporium ampelophagum*), side arm (*Fusicoccum viticolum*), crown-gall (*Pseudomonas tumefaciens*) and a non-parasitic disease known as chlorosis.

## INJURIOUS VERTEBRATES.

1351 - **The Plague of Voles and its Sudden Disappearance in the District of Ouman Kiev, Russia, in 1915.** — Россиковъ К. В. (Rossikov K. W.) in *Земледѣльческая Газета* (*The Agricultural Gazette*), Nos. 31, 32, 33, 35, pp.860-862, 885-886, 909-911, 957-958. Petrograd, 116.

During the last three years several Russian provinces have suffered very severely from an invasion of field voles; in Russia in Europe the plague has been most violent in the south and southwest and in Poland.

The writer was detailed by the Department of Agriculture to deal with this plague in the south-west, where special attention was directed to the Ouman district (Kiev) which was of theoretical as well as practical interest owing to the exceptional speed with which the country was overrun and to the sudden and complete extermination of the invaders. The first sign of the invasion in this district was noticed at the end of the summer of 1913; the area attacked did not include more than 25 acres of winter crops. In the spring of 1914 more than 2750 acres were invaded and towards the beginning of the autumn the area was increased to 27 500 acres, and it has since increased still further.

Fields sown with spring and winter corn, beetroots, clover and lucerne were all overrun by *Microtus arvalis* Pall.; in the same fields *Apodemus agrarius* Pall. and *Mus musculus hortulanus* Nordm. were also found, and less frequently *Mycromys minutus* Pall. and *Cricetulus arenarius* Pall. In clover and lucerne fields lying in damp places *Microtus arvalis* and *Chionomys ratticeps* Keys and Blos. occurred. In oak woods and mixed woods *Evotomys glareolus* Schr. came first in point of numbers, followed by *Mus sylvaticus* L., in copses and clearings *Microtus arvalis* was the most frequent, *Chionomys ratticeps* however appeared to a small extent.

Concerning the actual number of the invaders the following data are given. At the end of the summer of 1913 there were approximately 1 or 2 burrows present to every 5 square yards ; in the spring of 1924 the number had increased to 10 or 20, with 2 or 3 nests. The nests belonged to *Microtus arvalis* only. Later observations show that the area was not uniformly invaded: in the north-east of the district the average number of burrows was 1 to 5, in the south-east 5 to 10, and in the north-west 10 to 20 to every 5 square yards. Dealing only with small-holdings, the least densely populated area included about 67 622 acres, the average number of burrows, that is 5 to 10 per 5 square yards, was found in 62 420 acres, and the maximum in 12 137 acres. The land belonging to large land owners was invaded to the same extent. By the autumn of the same year the numbers were more than doubled, so that on an average there was a nest to every 5 square yards or about 1000 to the acre. Taking it for granted that each nest contains a male, a female and two young ones (the ordinary number of young being however not less than 6) it is clear that there were at least 4 000 voles to an acre.

Considerable damage has been done to crops. On the land sown with winter cereals the yield of grain was reduced by 2 quarters per acre; with clover and lucerne over a ton per acre of the crop was lost and in some places there was no clover and lucerne left at all. In short, taking numerous areas of 25 acres, it was calculated that at the end of June there were 100 to 150 burrows to every 5 square yards, and to give some idea of the number of nests it is only necessary to add that they were arranged on several levels one above the other. For mangolds the loss was estimated at 5 to 6 cwts. per acre. In the other districts of the province of Kiev and in neighbouring provinces the invaded area was smaller and the voles were less numerous.

The Zemstvo for the Ouman district in the autumn of 1915 allowed £ 1 960 to be devoted towards exterminating the plague. The other Zemstvos adopted a similar plan of action.

The second half of the autumn of 1914 was characterised in the province of Kiev by persistent rain, a little snow and frequent variations in the temperature between — 5° C. and 8° C. The winter was exceptional, damp and cold, with little snow but with so much rain that the fields became marshy.

Towards the end of January 1915, a local agricultural organisation made a careful survey of the region which was attacked most severely, with a view to exterminating the voles. In two of the lowest lying districts it was noticed that there was an obvious decrease in the number of these pests in the fields planted with winter crops. Bacterial cultures had been prepared by the Institute of Bacteriology at Kiev to be used in dealing with the voles, but before having recourse to these, the writer, accompanied by the farmers of the district, made a second series of observations on April 26, and he recorded in these two districts that almost all the voles belonging to the species recognised in 1914 had died off, not only in the fields bearing winter crops but in all the other localities that had suffered from the invasion.

In the spring floods to a depth of 8 inches had prevented last year's holes and burrows from being seen. In several places new holes were observed which had been made by animals that had escaped drowning by hiding in the stacks of straw left in the fields. In other places which had been less severely attacked and whose physical characters were rather different, the voles had suffered in the same way; that is, in the low lying fields which were flooded the mortality was very high, and in higher places which had been untouched by the floods there were not more than 5 or 10 burrows per acre, as against 30 to 40 per 5 square yards in the preceding autumn.

Judging from the fact that the species principally observed in the Ouman district do not hibernate and must therefore leave their holes every day even if it is only for a short space of time, and also taking into consideration the very unfavourable metereological conditions existing during the winter 1914-15, the writer concludes that the sudden extermination of the voles in the south-west of Russia was due to the weather. In

confirmation he gives an account of the results of laboratory experiments dealing with the effect of sudden temperature changes upon the mortality of these animals. The first case cited occurred between September 7 and 8, when after 3 or 4 cold days the temperature sank to — 30° C. on the morning of the eighth rising again to 8° at one o' clock and sinking to 2° at seven in the evening. Out of 70 voles which were exposed to these conditions and which had been perfectly healthy at 7 p. m. on September 7, 43 were dead by 7 p. m. on September 8, that is, rather over 60 per cent. The following table shows the mortality for the different species:

| | | |
|---|---|---|
| *Apodemus agrarius* | mortality . . . . . | 100 per cent |
| *Evotomys glareolus* | " . . . . . | 82 " " |
| *Microtus arvalis* | " . . . . . | 56 " " |
| *Mus musculus hortulanus* | " . . . . . | 50 " " |
| *Cricetulus arenarius* | " . . . . . | 33 " " |

The most resistant species are *Chionomys ratticeps* and *Cricetus cricetus* both of which survived the frost.

Other observations were carried out from September 29 to October 1 when the temperature dropped to — 3° C., with similar results.

These facts according to the writer show clearly the causes for the sudden death of the voles. Microscopic examination, both anatomical and bacteriological, of a large number of dead specimens revealed a perfectly healthy condition of the internal organs. This finally confirms the conclusion that the invasion of voles in 1914 in Kiev and in other provinces in the south-west of Russia was terminated during the winter by the metereological conditions only (excessive damp and warmth) and not by the intervention of the disease caused by *Bacillus typhi murium* Löffl.

RUGGERI ALFREDO, gerente responsabile.

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

# INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

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# PREFACE

This index, though arranged alphabetically, retains the grouping of the subjects used in the *International Review*. The arrangement of the subjects in each group is in chronological order of publication, except in the case of those relating to Agricultural Development, where the alphabetical arrangement was considered more useful.

Except in the case of the original articles, which are numbered according to their pages, the numbers of each subject refer to the paragraphs in the *International Review*.

The index consists of three parts : one, of the original articles, one concerned only with Agricultural Intelligence and the last with Plant Diseases.

This volume of contents has been prepared by the redacteur Dr. Giulio Provenzal.

# THE INTERNATIONAL INSTITUTE OF AGRICULTURE

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